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OCTOBER, 1900. VOL. XVI. NO. 4.

The Geographical Journal

INCLUDING THE PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.

SUMMARY OF CONTENTS.

(For Details, see over.)

	PAGE
The "Southern Cross" Expedition to the Antarctic, 1899–1900. By C. E. BORCHGREVINK	381
Studies in the Anthropogeography of British New Guinea. By Prof. ALFRED C. HADDON, Sc.D., F.R.S.	414
Geography at the British Association, Bradford, 1900	441
Political Geography and the Empire. By Sir GEORGE S. ROBERTSON, K.C.S.I.	447
The Origin of Land-forms through Crust-torsion. By M. M. OGILVIE GORDON, D.Sc., Ph.D., LL.D.	457
The Pettersson-Nansen Insulating Water-bottle. By HUGH ROBERT MILL, D.Sc., LL.D.	469
The Monthly Record	471
Obituary	481
Geographical Literature of the Month	482
New Maps	496
Maps and Illustrations.	

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The
Geographical Journal.

No. 4. OCTOBER, 1900. Vol. XVI.

THE "SOUTHERN CROSS" EXPEDITION TO THE ANTARCTIC, 1899–1900.*

By C. E. BORCHGREVINK.

It was on December 30, 1898—somewhat sooner than I had expected—that the *Southern Cross* first struck the scouts of the antarctic ice-pack, in lat. 51° 56′ S., long. 153° 53′ E. My experiences of 1894–95 justified the anticipation that we should encounter ice early on the southward voyage by going so far west; in fact, it appears to me that in this locality the ice conditions are always unfavourable. I had, however, purposely taken that course in order to satisfy myself respecting the land reported by Captain Wilkes, and which, it seems clear to me, was, in reality, Balleny. It was an anxious but interesting moment as I watched, from the crow's nest, the vessel as she rose on the swelling ocean and dashed in among the grinding ice-blocks. Trembling and shaking, she forged her way onwards, while the swell grew rapidly less as we successfully pushed into the inner ice-pack.

Since we entered the ice there had met us quite a different bird-life to that seen in the open sea, which had consisted principally of albatrosses (*Diomedea*) of several species, and various petrels, including the mutton-bird (*Œstrelata lessoni*) and *Prion vittatus*. The last-named followed us some distance into the ice, but it left us long before we came into the dense pack. A brown-backed bird with a white border to the wings, white underneath, and in body and beak much like a puffin, met us at once when we came into the ice, and was usually seen as long as the ice was slack, but after the pack got denser the bird was seldom to be seen. We saw from time to time specimens of

* Read at the Royal Geographical Society, June 25, 1900. Map, p. 500.

Ossifraga gigantea, *Oceanites oceanicus*, as well as *Daption capensis*, and some penguins (*Eudyptes adeliæ*). *Pagodroma nivea* and *Thalassoica glacialoides* were best represented. Among the seals we saw about this time were two young sea-leopards, as well as some white seals, one specimen of which appeared, from the form of the skull, to be different from the rest, though alike as regard the skin and the size. On January 8 we saw the first specimen of the giant penguin *Aptenodytes forsteri*, but did not succeed in securing it. On January 12 the bird-life was very rich. In the evening Mr. Hanson did some valuable work with the plankton bag, and brought in amongst other things a great many shrimps.

On January 14, 1899, when approximately in 65° 42′ S. and 163° E. long., I entered the crow's nest at midnight, and discovered high snow-clad land to the south. The land stood out sharply in a haze of crimson and gold, which grew more brilliant as the sun rose, until the contours of peaks and crevasses suddenly grasped the beauty of the young day and reflected it out all over the immense ice-pack, where the dark water-pools between the floes changed suddenly from deepest azure to blood red, while the young snow on the ice blushed in delicate crimson. It was Balleny island which we sighted.

The seals which were shot about this time seemed to be far advanced in moulting, and they looked a good deal darker in their new coats. The moulting starts on the back, in a straight line from nose to tail. It is remarkable that neither in the stomachs of the white seals, nor in the intestines, had food of any kind been found. Some few whales had been seen, mostly of the blue kind. On January 16, we were still lying fast in heavy pack, the wind blowing very hard from the south-west. We were in lat. 65° 43′ S., and long. 164° 9′ E. The compass error 26° 5′ E.

On January 18 we saw two large penguins (*A. forsteri*). It was a pair. These birds must have a wonderful power of location, as the male dived when about 600 yards from the vessel, reappearing close by the floe where his mate was seated, the intervening space being covered with ice-floes. On January 20, Mr. Hanson for the first time secured some skuas (*Lestris*). Like other species of *Lestris*, it was very curious, and came close to the side of the vessel. The 21st was noteworthy for the discovery by Mr. Hanson of a new species of seal. The body was not unlike that of the ordinary seal, but the neck was of more than ordinary thickness, and under the chin it extended to a great round muscular purse. The head was short and broad, the eyes large and protruding, and the mouth short. The eyes were somewhat slanting. It had six front teeth in the upper jaw, two in the under jaw, but no back teeth. On January 23 we experienced very heavy ice-pressure, tremendous ice-blocks rising violently against us. The *Southern Cross* sighed and groaned under the pressure brought to bear upon her. She was lifted 4 feet bodily out of the water on one occasion. During this

time Captain Jensen and I spent many cold and anxious hours in the crow's nest. For weeks we remained buried in the snow and ice, and as the summer advanced I began to foresee a possibility of not being able to get through with the vessel. Instead of trying the doubtful chance of getting southwards in the vicinity of Balleny, I determined, after consultation, owing to the advanced season, to work northwards towards open water, with the intention of making a fresh attack on the ice-pack further east. This plan was followed, and after a hard fight in the pack for 48 days, the *Southern Cross* ran into open water, lat. 70° S., and long. 174° E.

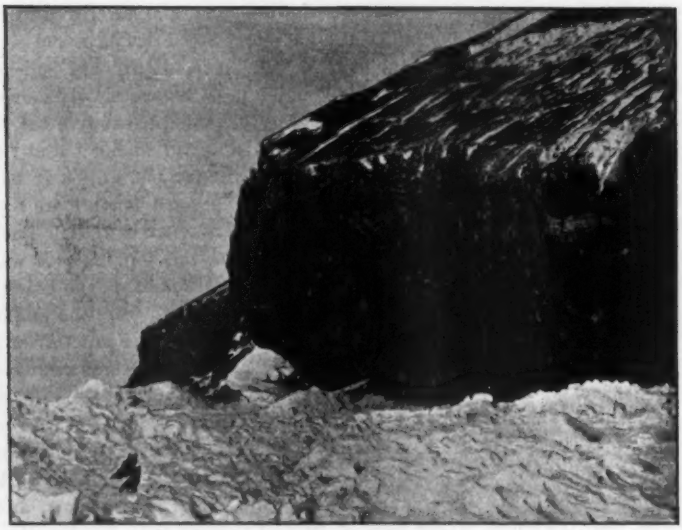
On February 15 and 16, the *Southern Cross* was compelled to lie to in a storm of blinding sleet, with decks and rigging covered thick with ice. On the evening of the 16th we sighted land, and entered Robertson bay on the 17th. The rocks of Cape Adare stood out dark and conspicuous as we steamed into the bay. It was a moment which, I believe, will live in the memory of my staff and myself, as we slowly moved towards the low beach whereon man had never attempted to live before. At 11 p.m., for the first time in the world's history, an anchor fell at the last *terra incognita* on the globe. Already while far out at sea it had struck me that the cape and its surroundings seemed much more free from ice and snow than was the case on my first visit in 1894. Then the cape had several feet of ice and snow on the top, now it was absolutely bare. Only here and there were ice-blocks left on the beach; the rest was dark and bare, and on the peninsula itself were the guano deposits, while at this late season only a few penguins were left. After a brief stay on shore, we returned to the vessel, and quickly all was arranged for a speedy commencement of landing our stores, instruments, dogs, and outfit. It was late in the season, and although Robertson bay, to my surprise, was free from ice at that moment, I knew that it might fill up again at any time. Already, on the 18th, we were hard at work landing stores. We lowered the boxes into small whale-boats, and pulled near the shore, where some of us had to wade into the breakers and carry the things ashore. On the 23rd we were suddenly interrupted in our work by a strong gale from the south-east. The gale increased, and developed into a blizzard.

On March 1, the Union Jack, presented by His Royal Highness the Duke of York, was formally hoisted on Victoria Land, greeted with loud cheers from those on shore, and with a salute and dipping of the flag from on board. The following day the *Southern Cross* left us at our pioneer settlement on Cape Adare, which I christened Camp Ridley.

On landing, I had carefully selected and taken on shore with me the following members of my expedition: Lieut. W. Colbeck, R.N.R., magnetic observer; Mr. Nicholai Hanson, zoological taxidermist; Mr. Louis Bernacchi, magnetic observer, astronomer, and photographer; Dr. H. Klovstad, M.A., M.D.; Mr. Hugh Evans, assistant zoologist; Mr. Anton

Fougner, general assistant; Mr. Colbein Ellefsen, cook; the Finn Savio and the Finn Must. I cannot but at once add that in their special departments all of these showed themselves exceptionally zealous and capable, and during the year that we fought shoulder to shoulder in those regions there always existed an honourable rivalry in making each of their several departments as perfect as possible.

On March 12 Mr. Bernacchi and I scaled Cape Adare to the height of 3670 feet, as indicated by the aneroid. The ascent was very steep for the first 800 feet, principally over worn rocks on the mountain-side. On the top there were great mounds of pebbles and large boulders stretching from east to west, on undulating ground. At 800 feet I



CAPE ADARE IN WINTER-TIME.

found vegetation of the very same kind as that seen on the lower rocks of Cape Adare in 1894, but none was seen above this height. The penguins had been up as far as 1000 feet.

About March 13 the temperature, which had previously kept about 22°, began to fall rapidly. Already on the 14th all the penguins had left us, while the skuas (*Lestris*), which were about in great numbers on our arrival, also began to get scarce. On this date Mr. Bernacchi and Mr. Colbeck completed their magnetic observatory in the large Finn tent, which was secured by stays of rope. The meteorological observatory, some 300 yards away from the huts, was also completed at the same time. On March 15 we saw the first Aurora Australis. On the

18th, having brought up all the stores to the house, we organized a preliminary expedition to the top of Cape Adare, whence I hoped to be able to reach the inner part of Robertson bay; but the very first night came on with a hurricane accompanied by driving snow, and we ran the risk of being blown over the cliffs with all our outfit. At camp Ridley the wind had a velocity of 87 miles an hour. At this date Robertson bay was beginning to freeze. The days were spent in frequent meteorological observations, which were taken every second hour, and whenever clear weather permitted, astronomical observations were made, the magnetic work going on whenever the magnetic conditions

THERMOMETER SCREEN.

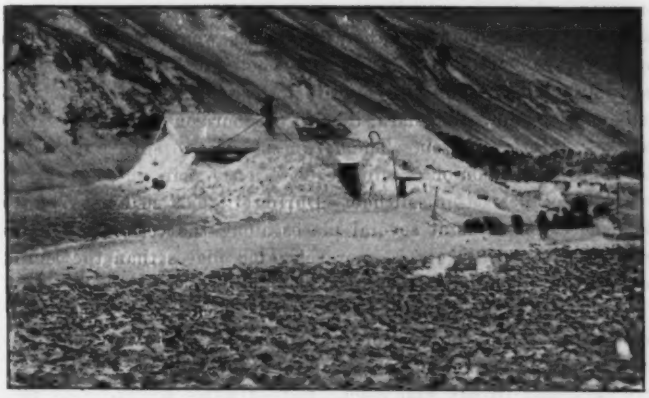
were favourable. The snowstorms which plunged down from the cape wrapped Cape Ridley in a dense whirl of snow-drift, by which the dogs were completely buried. The ice in the bay was completely ground up, and waves of snow, ice, and water dashed up against the beach and sent the spray flying over the roof of our camp. On April 8, when a heavy gale had ceased, on going along the beach, Mr. Hanson and myself were surprised to find, washed on shore, numberless specimens of medusæ, hydroids, star-fish, and algæ. Can it be that, after all, an extensive shallow-water fauna exists within the antarctic circle?

The roof of our hut we gradually covered over with sealskins, and, in expectation of further gales from the south-east, the eastern sides of

the huts were fortified by a sloping roof of good canvas and seal-skins, weighted down by numberless bags of coal. On April 8 Hanson discovered a fish, and shot a seal, which had fragments of partially digested fish in its stomach. Our health up to that date had been excellent. It was remarkable to see the quick rise and fall in the temperatures, and, considering the near approach of the winter, the temperature was comparatively high. From time to time we caught many fish in the bay. Some were over 12 inches long and about 7 inches in girth. I had photographs taken of all the specimens, and, whenever opportunity offered, photographs were taken of the various peaks on the coast within sight, and cinematograph photos whenever active incidents of interest occurred.

On April 22 I resolved to make a first attempt to penetrate into Robertson bay on the ice, which, though young, was already about 2½ feet thick. I took with me Mr. Fougner, Mr. Bernacchi, and the Finn Savio, provisions for twenty days, twenty sledge-dogs, and one small canvas boat. We left Camp Ridley at 11 a.m., and proceeded over the pack until darkness began to set in. The pack along the cliffs was rather small, and the ice which bound the floes together thin, so we had to proceed with great caution, and, when I at last decided to camp on a small beach at the foot of the perpendicular wall of Victoria Land, I had great difficulty in reaching the spot. The beach, or slope, where we pitched our tent was not 30 yards broad at the widest part, and only some 4 feet above water. From the perpendicular wall of Victoria Land a kind of gravel slide had taken place, and formed a steep slope about 30 feet high from the wall of rocks to the beach. Above us the cliff rose to about 500 feet, at places overhanging the little beach, which seemed completely isolated except by way of the bay. Shortly after landing, a southerly wind rose, which continued to increase till it became a violent gale. At seven the ice began to break up, huge breakers washing over the beach, and we had only just time to save our provisions by carrying them to the top of the gravel slope, where drift snow and ice had formed a sort of gallery about 6 feet broad, close to the mountain wall. In this, after immense difficulty, we pitched our camp, all working calmly, although fully realizing the awkward position in which we were placed. On Monday night, the 23rd, the bay was completely free of ice, and was perfectly calm. I then sent Mr. Fougner and the Finn Savio towards Camp Ridley in the small collapsible boat, with emergency rations sufficient for a few days. Shortly afterwards heavy ice came drifting rapidly into the bay, and we became very anxious about them, while we were ourselves without any craft whatever to take us from our momentary place of refuge. For two days we remained in ignorance of Mr. Fougner's and Savio's fate; but on the 25th, in the evening, both appeared on a very steep ice slope, descending from the perpendicular wall of Victoria Land. By the help of a little axe and an

alpenstock they cut footholds in the ice, and came slowly towards us. I soon discovered that they were in a pretty weak condition, and while Mr. Bernacchi started to cook some warm food for them, I began to cut steps in the steep ice-slope to meet them. At night we were again all safe in our little camping-place. Our comrades had spent two days and nights under the shelter of the canvas boat, and thought that they had discovered a possible place for an ascent to the ridge of Victoria Land some 5000 feet above us. The first 500 feet would, however, involve great risk. On the 27th I decided to make the attempt. Following the route by which Mr. Fougner and Savio had descended, we were enabled to reach the place where these two had camped, and saw the place likely to offer the only chance of escape. It was a rough kind of groove in the perpendicular cliff of Victoria Land, partly covered with ice and



CAMP RIDLEY AFTER THE FIRST SNOWDRIFT.

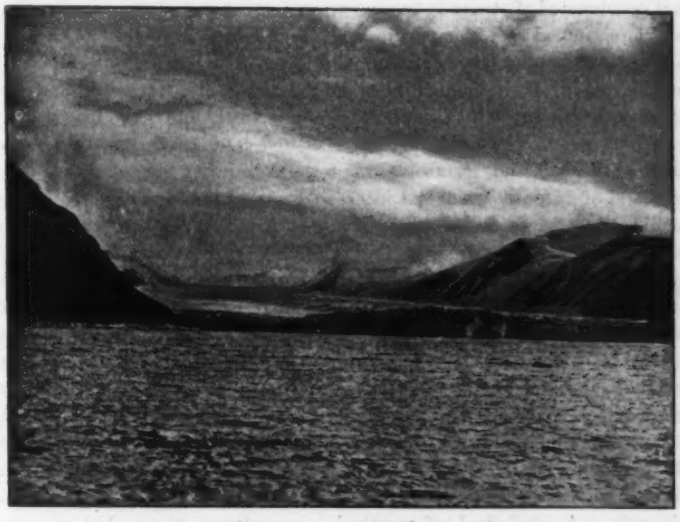
snow. After a good meal of seal beef, we began our ascent. Cautiously and slowly we climbed upwards, while the lesser slope some 400 feet above seemed continually to recede from us. All the night through we continued to climb, while the cold increased as we got up in the heights. By the ridge we were enabled to proceed to Camp Ridley, where great anxiety had prevailed, as our friends knew no place where we could possibly have camped.

We could now catch sufficient fish for our meals, thus gaining a valuable accession to our food supplies, and the knowledge that fish are to be caught will materially benefit future expeditions. The Aurora Australis was seen very often on clear nights. During May and June tremendous gales blew from the south-east, the wind often carrying stones with it. Great screwing also went on in the ice in the bay. The reading of the meteorological observations was often

carried out with great difficulty, and on one occasion Mr. Evans got lost in crossing from the thermometer screen to the house. We searched for three hours before finding him, and he was finally brought to the camp in an exhausted condition. However, under the careful treatment of the doctor he soon recovered. During the gradual shortening of the days we experienced great depression, as if watching ourselves growing old. We were getting tired of each other's company, and began to know every line in each other's faces. Chess, cards, and draughts were the most popular recreations. On June 3 the thermometer showed −31°, and some of my staff had the extremities badly frozen. As it was the Duke of York's birthday, the Union Jack, his present to the expedition, was hoisted, whilst a beautiful Aurora waved in mighty curtains over Camp Ridley. On June 15 another tremendous gale was blowing, lasting until the 17th, and making it impossible to collect the meteorological readings. Had we not had the sloping safety roof towards the east, I doubt whether the houses would have remained on *terra firma*. As will be seen from our meteorological observations, a great and sudden rise of temperature indicated the approaching gale. The days were now very dark, though the horizon towards the north-west was slightly crimson. The darkness and the silence in this solitude weigh heavily on one's mind. The silence roars in one's ears. It is centuries of heaped-up solitude. During the last sledge expeditions depôts had been made at several places along the coast in Robertson bay, and on the peninsula, in more elevated places than the camp, in case high water should at times rise above its level.

On July 26 I started on a fresh sledge journey, with the object of reaching the coast to the west of Robertson bay. At twelve mid-day I started with Mr. Evans and both of the Finns, taking provisions for thirty days, and twenty-nine dogs. For 12 miles we had very rough travelling, owing to the large ice-blocks heaped one upon another. At 4 p.m. we pitched our camp at the foot of an iceberg. As the ice conditions to the southward appeared very promising, I decided to send Mr. Evans back to Camp Ridley to tell Mr. Colbeck and Mr. Fougner to follow with more sledges and provisions, while I started southward, accompanied by the two Finns. We travelled all night without pitching camp, with a temperature of −25°. During the next two days it was misty. No land was to be seen, and I could get no observations. Towards evening on the 28th a gale came on with heavy drift, and we all remained inside the tent in our sleeping-bags. It was bitterly cold, and we suffered greatly from frost-bites, while the dogs froze fast to the ice. No land could be sighted anywhere. On July 31, having seen nothing of the party which was to have followed us up, we proceeded onwards on comparatively good ice. In the evening I discovered an island towards the south, and reached the western side of it an hour after dark. We were then very hungry and worn, the temperature was

−40° when we pitched the tent. I called this camp Midwinter camp, and the island Duke of York island.* On August 2 I resolved to investigate some of the coast-line of this island. I took with me the Finn Must, while I left Savio in camp to construct a kind of Finn tent out of provision bags, sealskins, and bags, which he proposed stretching over our sledges pitched on one end. Must and I proceeded along the northern shore of Duke of York island, and reached a bay which I named Crescent bay. During the succeeding days I made as thorough an investigation of the immediate surroundings of our camp as the cold and weather permitted. As I was getting anxious about the party



DUGDALE GLACIER (MOUTH OF).

which was to have assisted us, I began to take in stores of seal-beef and blubber. We suffered a great deal from cold and frost-bites, although we managed to keep up a blubber fire in the tent. However, both of my brave comrades kept up their courage, and were always cheerful. Having secured a valuable geological collection, in the middle of August we started back, and on this journey we experienced the lowest temperature we recorded—it reached −52°, or 84° of frost.

On our return to Camp Ridley, I decided to continue the explorations already begun in Robertson bay; partly from the great geological and other interest presented by that locality, and partly

* 71° 35′ S. lat., 170° 2¾′ E. long.

because I hoped to find there a likely place whence to penetrate further inland. Expeditions were therefore despatched during the remainder of August and September under the different members of my staff in turn, and valuable collections and observations were made. In the vicinity of Robertson bay, the great elevation of the land, which reached far above 12,000 feet, rendered it difficult to find a likely place for a journey into the interior. Glaciers thousands of feet in height precipitated themselves into the sea, sometimes at an angle of about 50°, and, being crossed by innumerable deep crevasses, rendered our expeditions on the coast both arduous and dangerous. The Finn Savio and myself worked in the vicinity of Mount Sabine for more than seven weeks, camping in a hut constructed of stones between two projecting rocks. During the time we were camped there communication with Camp Ridley was continually kept up, and stores brought thence to form a depôt at Duke of York island. While bringing supplies to the depôt, Mr. Bernacchi and Mr. Ellefsen had a frightful experience, being overtaken on the ice-pack by a furious gale. During this time I visited land to the south-west of Duke of York island, forming part of the Admiralty range, which, as it is a land of intense geological interest, I named Geikie Land. Moraine studies were made here, while Duke of York island was thoroughly investigated. Its position, similar to that of Doubtful island, discovered by Sir James Clark Ross, illustrates that remarkable formation which, in the close vicinity of great glaciers, makes it so difficult to decide whether the land really is an island or joined to the mainland as a peninsula. Duke of York island is cut through from east to west by broad, deep quartz reefs. Suffice it to say that minerals of value occur in this vicinity, justifying the belief that in time to come exploration will receive much support from commerce. I took formal possession of the island for Sir George Newnes by the hoisting of our Union Jack. Geikie Land, which we visited on several occasions, is likewise rich in minerals. A good deal of vegetation was found there, but we experienced great difficulty in penetrating further inland. Sledges with provisions were taken up ridges, across glaciers, and down precipices; and when we could bring them no further we loaded ourselves, and with ropes and alpenstocks we climbed the steep slopes. Exhausted and frozen, we returned to our stone hut after numberless attacks on these inaccessible ranges.

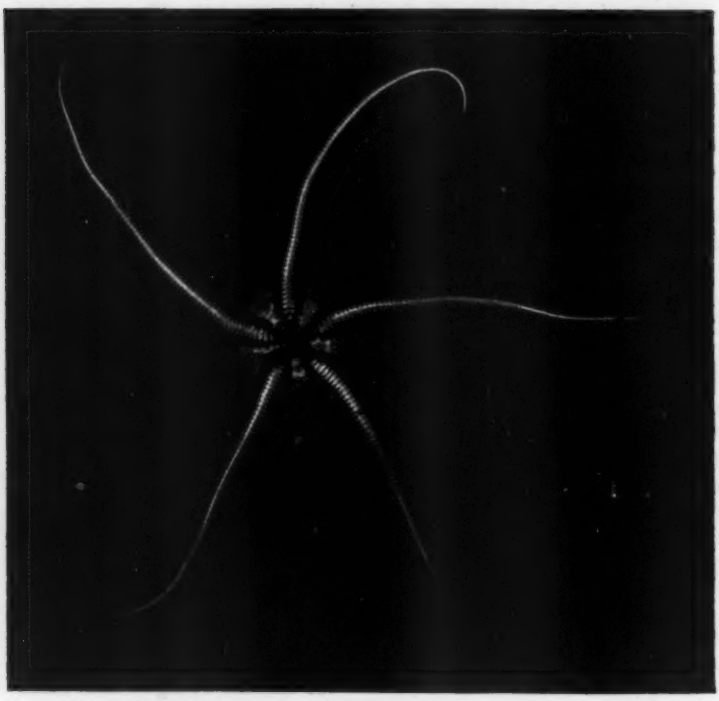
The last report from camp told that Mr. Hanson was in a low condition and under medical treatment, having lost feeling in his legs, and being only able to walk with difficulty. The Finn and myself began to suffer severely from rheumatism, and Mr. Colbeck suffered too with neuralgia. On October 4 I started back for Camp Ridley with Mr. Fougner, and on arrival found Mr. Hanson's condition very low indeed. In spite of all the doctor's care and attention, he daily grew worse. At two o'clock in the night of October 14, the doctor called me in my

sleeping-bag, and informed me officially that Mr. Hanson had not long to live, that he had informed him of his condition, when he expressed a wish to say good-bye to us all. I found him quiet, and without pain. He calmly bade me farewell, and confided to me his last wishes, choosing himself the place where he wished to be buried—at the foot of a big boulder some thousand feet up Cape Adare. The next day, about three in the afternoon, he died without pain, keeping conscious up to the very last. Half an hour before he died the first penguin came back. Enthusiastic as he had always been in his calling, Mr. Hanson asked to see the bird, and was delighted to examine it. The doctor's official report says that he died from occlusion of the intestines. We buried him on October 20.

Penguins now arrived on the peninsula in great numbers, and we looked forward eagerly to the time when we might expect to get eggs. I continued during the remainder of October to send out expeditions in the vicinity of Robertson bay, all of them bringing back splendid collections, both biological and geological. Before the end of the month the ice-pack seemed to begin to slacken. I placed water-tight oaken casks both in the hollows of the icebergs and on the floes, enclosing a communication, in which I stated the results of the expedition, and requested the finder to forward it to the Royal Geographical Society, with details of the locality and circumstances under which it should be found.

On November 3 we got our first penguin eggs, which we devoured with eagerness. I at once ordered my staff to commence collecting eggs, which we put down in salt in case the vessel should not return, and we should be left for a longer time than we had expected. During the winter, both away from and in the main camp, we had lived chiefly on seal-beef; now penguin flesh and eggs formed a great resource. Mr. Fougner was now doing very valuable work for the marine biological department, numberless specimens of starfish and jelly-fish, as well as algæ, being added to our collections. The peninsula was now literally covered with penguins (*Eudyptes adeliæ*), and still a constant stream of new arrivals could be seen far out on the ice, like a long endless black snake winding in between the ice-floes. As no open water was to be seen anywhere, not even a vapour-cloud indicating the near neighbourhood of any, these welcome travellers must have had a long walk. With short interruptions we had continually experienced heavy gales, some of which exceeded 90 miles an hour. These gales naturally considerably checked the progress of sledge expeditions. Nearly all the provisions had to be taken with us, as little bird-life was seen except on the coast-line, and the frequent gales always necessitate a great percentage of idle camping days, when much of the provisions for the inland journey will be eaten without a corresponding advance being made.

According to our meteorological observations, no one ought, in my opinion, to start a sledge journey in these latitudes without taking into consideration the likelihood of getting at least 20 per cent. of checking gales. We have not here those aids which are found in the north, in the bears, foxes, musk-oxen, and reindeer of the Arctic fauna. Life depends entirely upon a careful selection of the necessary provisions, and nearly double the quantity necessary for the distance to be



STARFISH FOUND IN 20 FATHOMS AT CAPE ADARE (HALF NATURAL SIZE).

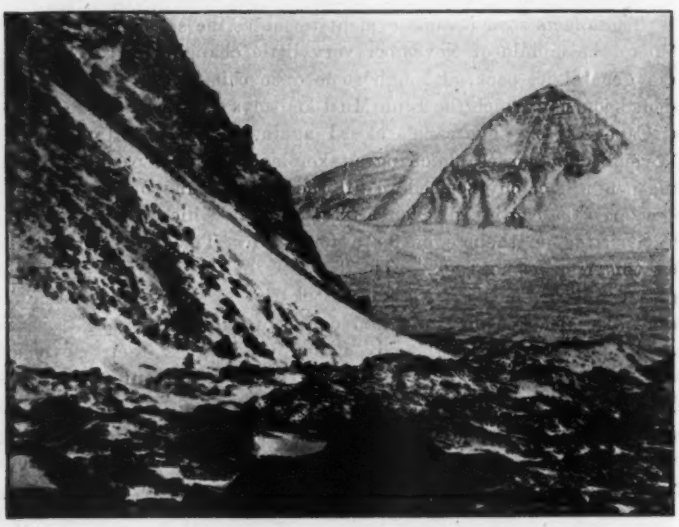
travelled must be taken, because of these powerful gales, in which it is not only impossible to travel, but difficult even to exist. These facts, besides the great elevation of Victoria Land and its difficult glaciers, make travelling within the antarctic circle quite a different matter to that in the arctic regions. In the vicinity of Cape Adare, a position which corresponds to that of Northern Norway, the ice and meteorological conditions cause much greater danger to the traveller than in those higher latitudes in the north which are ruled by similar average

temperatures. It seems as though an early break-up of the ice in the bay eastwards of the land stretching from Cape Adare down to the active volcanoes Erebus and Terror takes place every year, and occasionally I presume that the ice even breaks up for a week at a time in late autumn and early spring; thus travelling at sea in the pack, as well as in Robertson bay and in the vast Ross bay to the east, will always be perilous undertakings. In my opinion, successful exploration within the antarctic circle must always be confined to one locality, for if too large a field for operations were chosen, the natural conditions and the variable antarctic climate would make failure probable. Necessarily also there ought to be close co-operation between expeditions on land and at sea—between vessels and sledges.

These facts soon became evident to me as the season drew onwards. Up to the middle of November very little change was to be seen in the general ice-pack, although some open canals were met with on a sledge journey which the Finn Must and myself carried out to the east of Cape Adare. The canals closed again, and not until the end of November did noticeable changes take place in the ice-pack. Although the penguin colony seemed to fill the very ground of the peninsula, new arrivals continued even after the birds which arrived first had been sitting on their eggs for a fortnight. The skuas (*Lestris*) had by this time come back. The boldness of these birds is such that on several occasions I saw them attack the dogs, and nearly all of us were also attacked on more than one occasion. The *Pagodroma nivea* and the giant petrel also arrived, and we watched their movements with great interest to discover the places where they intended to nest. Our efforts were rewarded, and the extensive egg-collection which the expedition brings back is the result of sledge journeys to Duke of York island, to Geikie Land, and to the vicinity of Mount Adam and Mount Sabine.

After the middle of November dark vapour clouds were continually to be seen towards the eastern horizon, and on one occasion the temperature rose to +18°. I went with the doctor towards the cape and found a large sheet of water, in which a strong current was running at a rate of from 5 to 6 knots. The ice was evidently wearing rapidly by this time, the current increasing perceptibly in strength from day to day. It seemed improbable that those abnormally violent gales would blow again before the autumn, the summer being so far advanced. As the bulk of the immense ice-pack still remained with very few interruptions, we began seriously to contemplate the possibility that the ice-conditions of the previous season had been exceptionally favourable, and that the *Southern Cross* might be unable to reach us. Strict precautions were therefore taken against using more than the necessary food, while we continually added to our provisions by seal-beef, penguins, and eggs. Clear, calm, comparatively warm days became now frequent. Mr.

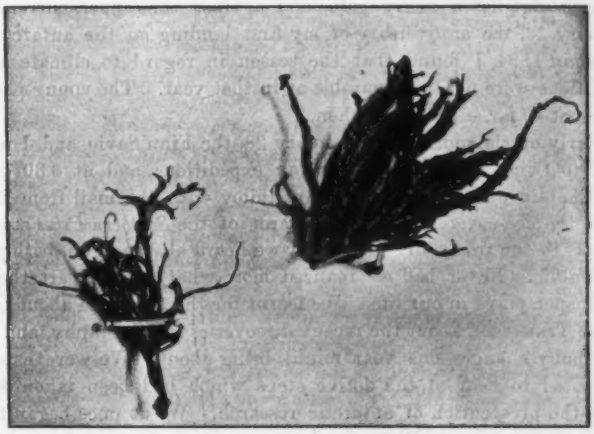
Bernacchi and Lieut. Colbeck were now making the final arrangements for observations of the total eclipse which was to take place on December 3. However, our expectations were doomed to disappointment, the day proving overcast. Some interesting temperature records and time observations were, however, registered in connection with the eclipse. The ice now began to break up in earnest. It is clear that all the pack-ice must needs take a westerly course under the influence of the prevailing wind, and northerly under that of the current. It was therefore likely that my instructions to Captain Jensen not to go further west than 170° would cause the *Southern Cross* to reach open water at a comparatively early part of the antarctic summer.



PART OF THE MEDIAL MORAINE AT GEIKIE LAND.

On December 10 I started on my last sledge journey into Robertson bay, principally for the purpose of securing eggs of the different birds. On this journey a remarkable discovery was made by the doctor. I had sent him on a short expedition into Admiralty range for the purpose of collecting specimens of the vegetation on Geikie Land. When he came back, he was proud to show me several insects of three distinct types, which he had found in the mosses. This discovery is naturally very far-reaching. The existence of insects throws a satisfactory light on our meteorological work, and it is improbable that the temperatures about Geikie Land will fall much below those we had experienced, otherwise the life of insects would not be possible. It may be that we had experienced a comparatively cold winter. From Crescent bay, on

Duke of York island, we entered a bay to the south-east—an arm of Robertson bay—at the end of which I found a very low and easily accessible land, the beach rising from the water to the height of about 30 feet. The land was formed partly by the glacier, and partly through stone-shoots from the mountain side to the north-east. As a dividing line between this work of the glacier and that of the mountain ravines, a small stream came rippling down among the boulders and rocks from two small lakes, formed through the melting of the great glacier, which I named the Murray glacier. Before we returned to Camp Ridley, we explored this neighbourhood to the height of 1700 feet, at which height we found vegetation. When travelling back, we



REINDEER MOSS (LICHEN).

found that a good deal of water had accumulated near the coast-line and made the landing with sledges and gear difficult.

As I remarked in 1895, after my first antarctic journey, it must strike any one with an eye for geological science how the nature of Victoria Land speaks of evolution. One need only look at the moraines, the empty glacier beds, and the worn rocks of Victoria Land to be convinced that these lands must have changed during periods comparatively not very distant.

On the 27th the report from the top was to the effect that no ice was to be seen towards the north, even through the telescope. To the north-west and west much ice was, however, in view. Along the beaches of our peninsula the ice was getting unsafe for travelling. Several young penguins were out of their shells, and Mr. Evans, who had taken over Mr. Hanson's department, collected specimens of the

young ones from day to day in order to get the series in their growth. Mr. Fougner secured a magnificent specimen of a jelly-fish.

New Year's Day broke bright and clear, with the Union Jack flying merrily at the flag-staff, and we looked back with feelings of pardonable pride on the work accomplished by us during the year just sped. On January 5 there was open water as far as the eye could reach towards north and east. We swept the horizon, but no signs of the returning vessel were to be seen. Although there was open water everywhere, many huge icebergs were now seen to drift northwards past the cape. Some few seemed to be influenced by a strong under-current, which brought them into Robertson bay, where the larger ones ran aground. It was an interesting sight to witness these bergs sail into the bay straight against a heavy gale, and against the upper current. On January 23, the anniversary of my first landing on the antarctic continent in 1894, I found that the season in regard to climate and ice conditions were not so favourable as in that year. The young penguins were not so far advanced as then.

Early on the morning of January 28, the Finn Savio and I paddled back to Camp Ridley from a kayak expedition; and at 8.30 on that day Captain Jensen entered Camp Ridley with the mail from Europe, while the ice-covered masts and yards of the *Southern Cross* stood out sharply in the frosty air. Gradually we heard all the news, both private and public. Never had we realized more what a large part the daily newspaper plays in our life. We learnt for the first time about the war in the Transvaal, about the recent discoveries in telegraphy, and found how many changes one year might bring about. We were especially interested to hear of the active steps which had been taken to continue the prosecution of antarctic research. We at once began to take on board from Camp Ridley such stores as were wanted for our southward journey. The dogs, sledges, instruments, and fur were likewise brought on board; and after visiting Mr. Hanson's grave, we all embarked, leaving at Camp Ridley the huts, a quantity of coal which would have kept us for another year, a considerable amount of provisions, and a small note from myself to the commander of the next expedition. In the evening of February 2 we steamed away from Camp Ridley, and I had again the united expedition of thirty souls under my command.

Taking repeated bearings of Victoria Land for mapping purposes, we arrived at Possession island at 6 a.m. on February 3. Instruments and cameras were put into a boat, and I effected a successful landing with the whole of my staff. On Possession island we found the post with the iron box left there by the antarctic expedition of 1895. I left a letter in that box with the names of those who had landed with me, and after collecting specimens of rocks and vegetation, and securing as many photos as possible, we reached the vessel without mishap. On February 4 we had a fine day, each undulation and white peak of Victoria

Land standing out clearly defined against the blue sky. At Coulman island I again effected a landing, after which, principally on account of the magnetic observations which would be invaluable in this locality, the course of the *Southern Cross* was laid westwards. Since leaving Cape Adare the temperature of the water had risen from 28° to 30°. The land for some 40 miles inland appeared considerably lower than the ranges near Cape Adare, but in my opinion even here there would be no opportunity for a sledge party to proceed successfully far inland. However, having penetrated as far as possible towards the land to the west of Coulman island, and to the south of a conspicuous cape, which I named Cape Constance, after my wife, we found a bay in an ice barrier, or rather in the seaward edge of the ice-sheet, descending from Victoria Land. We found an admirable place for the magnetic observations, which were made on the ice by Mr. Bernacchi and Lieut. Colbeck, and which were of the greatest value for the location of the present position of the south magnetic pole. The dip taken here was 87° 18′. With the aid of sledges we reached the end of the bay, where we found very many seals. On leaving this locality on the 4th, we had considerable difficulty from drift-ice. On the 5th we steamed southwards, and saw a great deal of pack-ice towards the west, so the coast-line here could not be distinctly mapped for some distance. On the 6th we were in lat. 74° 32′. We sighted continuous land towards the west, and as little pack-ice was seen, I decided to risk an investigation of the fjord, to the north of the range which terminates in Cape Washington, as here also I hoped to be able to afford my magnetic observers the necessary opportunity. Proceeding westwards for about 20 miles from the cape, we discovered a promontory almost clear of ice and snow, with a beach of about 100 acres. There I effected a landing with the whole of my staff, including Captain Jensen, and two sailors. The promontory runs north-west, leaving a cove, apparently a splendid winter harbour, to the southward, where Mount Melbourne rises to a height of about 12,000 feet. Its conical volcanic top was distinctly reflected into the clear cove, and reminded me of Mount Etna; while the midnight sun surpassed itself in splendour. To the south-east the peninsula or promontory was undulating, and rose in wonderfully worn shapes to the height of about 700 feet, affording wild and magnificent scenery. Large pieces of brimstone and lava covered the ground. A sharply defined ice-line intervened between this dark peninsula and the foot of Mount Melbourne. Evidently this promontory was formed by a volcanic eruption of Mount Melbourne, the side of which, however, was covered with a thick sheet of ice and snow. We found vegetation here of two different kinds, very many skuas, plenty of seals, and a small penguin rookery.

On the 7th, at 8.30 a.m., we passed Cape Washington, the coast-line towards the south-west gradually appearing lower. Here and there dark conspicuous rocks protrude from enormous glaciers. At midnight on the

7th, Lieut. Colbeck and Mr. Bernacchi were again able to take a dip observation on the ice. Mount Melbourne could still be distinguished to the north-west through the misty air, while ahead of us Franklin island rapidly grew more distinct. At 5 p.m. we effected a landing on its western side, on a pebbly beach very like the peninsula at Cape Adare. There were very many penguins on the peninsula, many more than were left at Cape Adare when we last said farewell to Camp Ridley. The most interesting discovery, however, was made in the marine zoological department, Mr. Fougner securing a rich collection of the shallow-water fauna. On the 10th, at twelve o'clock noon, the *Southern Cross* was in 77° 17′ S. lat., and 168° E. long. We had, immediately towards the south, Mount Erebus and Mount Terror, some misty clouds hanging round their tops. The coast-line is ice-bound, with a barrier about 7 feet thick, and only here and there broken by a projecting rocky promontory. Cape Crozier is comparatively free from ice and snow. We secured photos of Mounts Erebus and Terror, the former volcano being in activity. I effected a landing at the foot of Mount Terror, taking with me Lieut. Colbeck, Captain Jensen, and two sailors. The beach was formed by *débris* from an overhanging rock about 500 feet above, and did not exceed 10 feet in width and about 4 feet in height.

Shortly after landing, Lieut. Colbeck, at my request, went back with the two sailors in the boat to fetch a camera, while Captain Jensen and I busied ourselves in collecting. Suddenly a tremendous roar commenced overhead. At the first moment the thought passed through my mind that the overhanging rock was coming down upon us. In the next I realized the dangerous fact, and communicated it to Captain Jensen, who simultaneously recognized that the glacier immediately to the west of our little beach was giving birth to an iceberg. Quick as thought the event followed. With a deafening roar a huge body of ice plunged into the sea, and a white cloud of water and snow hid everything from our view. There was absolutely nothing to be done, and we both foresaw what immediately afterwards followed. A tidal wave—if I so may term it, because of its similarity to such—a raging, rushing wave, rose like a wall from the plunge of this million-ton mass of ice. It seemed rapidly to grow as it hurried towards our low ledge. We instinctively rushed to the highest part of our beach and stood close to the perpendicular mountain wall. The wave, which must have had a height of from 15 to 20 feet, seemed long in reaching us. It struck me first; lumps of ice dashed against my back, and I clung to the rock until I felt that the blood rushed from beneath my nails. I had just time to call out to Captain Jensen to cling to the rock, when the icy water closed over my head. When it had passed Jensen was still at my side. The next few waves were several feet smaller, and only washed about us up to our arm-pits, but the drag of

the water when it returned from the cliff tried us almost beyond our strength. Had it not been for a projecting ice-slope, which seemed to break the wave in its advance, we should undoubtedly have been smashed against the rock; for where the wave, unchecked, hit the wall some 10 yards beyond us, it tore away stones and left a mark of moisture some 20 feet above our heads, while marks of spray were to be seen still further up. Far out at sea the boat was returning with Lieut. Colbeck and the two sailors: they saw all that had happened to greater advantage, and of course realized the full extent of the danger we were in, Lieut. Colbeck having saved his boat from being swamped

A TYPICAL ANTARCTIC ICEBERG.

only by the exercise of considerable presence of mind. As it was, both Captain Jensen and myself escaped with a good deal of knocking about, and of course wet to the skin and chilled by the icy bath; but a splendid collection of rocks and vegetation soon made us forget the incident, which might have ended disastrously for us.

I now decided to steam southwards. To the south-east Mount Terror runs into the ocean with a rather gentle slope, and this part, curiously enough, is free from ice and snow, though the cone is covered in a mail of ice. No evidence of activity was noticed in this volcano. The eastern quarter of the coast-line of Mount Terror is not ice-bound, but from the south-east cape a high continuous ice-barrier stretches to the east-south-east, apparently about 60 feet high. From the crater of Mount Erebus a smoke-cloud was from time to time shot up into the

frosty air. A very biting breeze from the south was blowing; the thermometer marked several degrees below zero, and the deck, rigging, and sides of the vessel were all covered with ice. We proceeded along the barrier, slowly gaining some southing. On the 12th we were in 78° 4′; the barrier was still unbroken, but it seemed now inclined to take a somewhat southerly bend. In the evening we must have been in about 78° 10′. On the 13th a strong gale, with heavy seas and thick snow-drift, commenced. The *Southern Cross* had several feet of ice on her decks, bulwarks, and sides, and crew and staff suffered severely from the cold. In the intervals between the thick snow squalls tremendous icebergs hove in sight. On the 14th the gale somewhat lessened. On the 16th we were still proceeding southwards, with plenty of pancake ice around us. On the 17th, while in lat. 78° 34′, and E. long. 195° 50′, I discovered a break in the barrier with low ice towards the east. At this place I effected a landing with sledges, dogs, provisions, and instruments; and leaving the vessel with the rest of the expedition in charge of Captain Jensen, I myself, accompanied by Lieut. Colbeck and the Finn Savio, proceeded southwards, reaching 78° 50′, the furthest south ever reached by man.

On the 19th the voyage towards civilization commenced. On March 30 the *Southern Cross* dropped her anchor at Stewart island, New Zealand, where fresh food was brought on board. Here I left the *Southern Cross*, with instructions to Captain Jensen to proceed to Hobart, while I gained the Bluff, New Zealand, in a small fore-and-aft schooner. We arrived there at midnight, and I was enabled to send the following communication to Sir George Newnes: "Object of expedition carried out. South magnetic pole located. Furthest south with sledge, record, 78° 50′. Zoologist Hanson dead. All well on board.—BORCHGREVINK."

APPENDIX.

PHYSICAL GEOGRAPHY AND GEOLOGY.

The general aspect of Victoria Land is that of a wide, elevated, mountainous country, with peaks rising to the height of between 10,000 and 12,000 feet above the sea-level, precipitating into the antarctic ocean innumerable broad glaciers, traversed by deep yawning crevasses, which present an almost insurmountable barrier to the progress of the traveller. It is remarkable how free from ice and snow Victoria Land is at places near the coast. Cape Adare, Duke of York island, Geikie Land, Doubtful island, Possession island, parts of Coulman island, Cape Constance, Newnes Land, Cape Crozier, and numerous places between these conspicuous antarctic landmarks, are all bare of ice, most of them producing vegetation in the summer. At Newnes Land a minor eruption at the side of Mount Melbourne may account to some extent for the hospitable appearance in this locality; but the presence of the penguin colony there in their old nests, and the vegetation, indicates that the place for a considerable time past has been undisturbed by the forces within Mount Melbourne. Gales of course sweep the snow

away from many places, but this cannot be the general explanation, for some of the features mentioned, especially the camping-ground at Newnes Land, are rather sheltered. The land seemed to get somewhat lower south of Newnes Land, although through the telescope immense peaks were discovered in a chain far inland; but pack-ice prevented us from pushing close up to the land between Cape Washington and Mount Erebus. However, I regard Newnes Land and the vicinity of Cape Neumayer and Cape Gauss as of special geographical interest, apart from the desirability of these places as magnetic stations. At Newnes Land a party ought to winter. We observed many fjords penetrating Victoria Land from the coast, especially in the vicinity of Newnes Land, where the inner part of Southern Cross fjord still remains to be explored. It, as well as Wood bay, was blocked by ice at the time of our visit, but I consider it a particularly suitable place for the establishment of a winter station.

The geological and mineralogical specimens collected are to a great extent a more complete series of the rocks which I secured at Victoria Land in 1894. Most of the rocks are of volcanic origin, and represent basaltic lava-flows which have taken place during late geological epochs. The specimens I brought from the South Victoria continent differ but little from those I found on Possession island, but distinctly new features are to be found in Duke of York island and in Franklin island. I also collected this time a rock with indistinct granular structure which much resembles the garnet sandstone of Broken hill. The particular specimen is composed of quartz, garnet, and felspar fragments. On Duke of York island broad quartz reefs are to be found; but a complete report upon the geological and mineralogical conditions of South Victoria Land can of course only be made when microscopical and chemical tests have been applied. The moraine studies will, I think, prove of considerable value, both in regard to the geological formations near the coast and to the movement of the glaciers.

Ice Conditions.

The antarctic icebergs are in appearance of two distinct kinds, although, in my opinion, they have a similar origin. They are either discharged from what is ordinarily understood as glacier, or broken from the big barrier in the extreme south. However, to my mind, this barrier is merely the northern extremity of a great ice-sheet sloping northwards from land near the South pole, which is really nothing more or less than an immense glacier. The bergs discharged from a glacier, which has descended from a great elevation and been squeezed between immense peaks, will naturally have a more rugged appearance than those discharged from the gently sloping ice-sheet. The former are often overturned when forced into the sea, the latter break gently off through the great but steady pressure of the ice-sheet; and the iceberg will, even after the calving has taken place, maintain the character of the barrier or ice-sheet from which it was derived. The uppermost part of the bergs broken from the barrier is generally formed by a horizontal layer, from 30 to 40 feet thick, of ice due to snow-fall, which, under the pressure of the wind, has quickly taken the nature of ice, but remains easily distinguishable, by its white colour and soft structure, from that of the under part, the clear green and blue stratified glacier ice. Under the influence of the prevailing under-current these monarchs moved north-eastwards. The pack shows distinctly two kinds of ice, with different origins: on the one hand, that which is formed by the freezing of the sea; and on the other, the smaller ice broken from glaciers or from the extremity of the ice-sheet in the south. The difference between the two is not always so marked as to be distinguished without careful observation, the pressure and screw in the sea-ice near the coast of the

antarctic continent being so great that the blocks are reared on end, and would, to a casual observer, appear like glacier ice; but a nearer investigation will show two distinct structures. It is the land ice, or glacier ice, in the pack which, being harder and more angular, is most dangerous for ice navigation. The general movement of the antarctic ice-pack is apparently north-easterly, this direction being determined both by current and wind. The open water to the east of Victoria Land is undoubtedly due to the heavy south-easterly gales, as also to currents setting east of Victoria Land, and to the comparatively warm water in that locality. Active volcanoes above and below the sea-level probably play a considerable part in altering ice conditions. In travelling towards my furthest south on the southern ice-sheet, I noticed that here and there the surface rose in small cones, which at places were broken into rough walls of about 30 feet. Sometimes the ice-sheet suddenly took a terrace form, but this was always local, and the general nature of the surface was that of an immense white unbroken flat, with a scarcely noticeable rise towards the south. With a sufficient number of reindeer, sledges, and dogs, and a very small party of scientific men, I believe that a high southern latitude may be reached on this ice-sheet in the proper longitude.

A vessel bound for Victoria Land ought not, without special reason, to proceed west of 170° long. E. November and December is, I believe, the best time at which to approach the ice-pack. A general break-up of the ice does not take place before the end of January, and I do not think that under normal conditions a vessel would succeed in reaching Victoria Land much before the beginning of February. I regard the success of Sir James Clark Ross, without the help of steam, unquestionably as a sign of exceptionally favourable ice conditions in the year when the *Erebus* and the *Terror* penetrated into the antarctic ice-pack. In ice-pack similar to that encountered by the *Southern Cross*, sailing vessels would be entirely helpless and at the mercy of the pack. The progress of a vessel in the antarctic pack depends, according to my experience, very much upon the locality in which the pack is attacked, and also on the meteorological conditions. In the absence of land to the north, the big swell of the south-westerly trades reaches the antarctic pack, causing great pressure, under which a very heavy screw takes place and threatens to crush the staunchest of vessels, while sledge journeys become at times impossible. It also happens that even after the ice is 2 or 3 feet thick, a gale of 100 miles an hour begins to blow, and the ice which may have been absolutely safe for travelling one hour, has the next been ground up into furious rolling waves. In Robertson bay the ice did not attain a thickness of more than 5 feet, and at places it was only 2 feet thick throughout the winter. I believe this to be greatly due to the strong currents which prevailed in and near Robertson bay.

Zoology.

Birds.—The common penguin of Victoria Land is the *Eudyptes adeliæ*. As in 1894, the rookery of these birds at Cape Adare covered the whole peninsula of Camp Ridley, their nests, placed above the guano deposits, being formed of small pebbles, probably blown from the top of the cape by the gales. In 1894, the colony was inhabited almost entirely by white-throated penguins, whereas those met with on our outward voyage in 1899 had nearly all black throats. I was able to prove that both are of the same species, the young birds, which are left behind when the old ones go to sea, having more or less white throats. It was curious to see the penguins as they invaded the peninsula in the spring, one continual stream passing over the ice from October 14 onwards. They at once started nest-making, taking possession of their old places, and bringing new pebbles to the nest. During the time of love-making they had many hard fights. As a general rule two eggs are

laid, but very seldom three are found in one nest; the period of incubation, during which both birds take their turn in the nest, lasted in 1899 from the beginning of November to early in December. During heavy gales, the birds, which ordinarily sit upright or lie facing various directions, all turned with their beaks to the south-east, the direction from which we had the heaviest gales. The skua is the worst enemy of the penguin, constantly soaring over the nests and watching an opportunity to steal an egg or young bird.

We saw comparatively few of the emperor penguin (*Aptenodytes forsteri*), nor were we able to find their nesting-place. In the autumn of 1900, we for the first time saw several together, and even then only in small numbers. They came swimming like the small penguins, with which, however, they did not mix.

No specimens of the king penguin (*A. pennanti*) were seen.

The skuas (*Lestris*) arrived somewhat later than the penguins, and their eggs were also laid later. They made their nests in the heights, up to 1000 feet on Cape Adare.

Of petrels, the *Oceanites oceanicus* also hatched on Victoria Land, the nests being found in cracks of the rocks and under boulders. The elegant white petrel (*Pagodroma nivea*), with black eyes, beak, and feet, likewise builds in cavities of the rocks. These birds are attractive both in appearance and habits. The pairs show deep attachment, and the courage of the male is indomitable when his mate is in danger. The brown-backed and giant petrels were seen, but their nests were not discovered. I believe the former nest on Geikie Land. The giant petrels seemed to arrive before the approach of gales, and I attributed their visits to strong gales at sea, which drove them towards the shore for shelter. In their flight they much resemble the albatross.

Seals.—The seals we encountered in the pack on the southward voyage were, as they always have been found in the antarctic regions, scarce, all of them being hair-seals. Besides the sea-leopard, Weddell's seal was the best represented. We found the characteristic white seal of the antarctic in greater numbers than in 1894; and Mr. Hanson made, at my special request, as good a study of this interesting species as time, specimens, and opportunity allowed. As we proceeded southwards, the number of seals basking together increased considerably, and in the vicinity of Coulman island and Cape Constance, in Lady Newnes bay, we saw as many as 300 together. These were Weddell's seal. The new species of seal discovered by Mr. Hanson in the pack was very poorly represented, and we only secured four specimens of them altogether. These were three males and one female. In the vicinity of Cape Adare seals were to be found nearly all the winter; either on the ice near their blow-holes, or in the water at these holes, which they managed to keep open in Robertson bay nearly all the winter. I had hoped to have found that the white seal would breed in Robertson bay, but was disappointed at finding that this was not the case. The Weddell's seal and sea-leopard both bred in Robertson bay, and we frequently found the young ones on the sledge journeys. The seals, like the penguins, provided us with fresh food.

The Shallow-water Fauna.—In Robertson bay there is an abundance of fish, and in all we discovered about five different kinds. One particular species was often over 12 inches in length. The most remarkable form was a fish about 9 to 10 inches long, with a body much like that of the jack, with a very long under-jaw reaching beyond the upper, and armed with two very sharp, comparatively long teeth inclined backwards. The head occupies nearly one-third of the entire length of the fish. It is a greenish-grey colour above, and lighter underneath. Another remarkable fish is absolutely white. It has much the shape of a herring. Of lower organisms, caught principally by the dredge, medusæ were well

represented. One large jelly-fish was caught near the peninsula with arms about 12 yards long. Its weight was 90 lbs. Smaller jelly-fish, several kinds of star-fish, shells, sponges, and a variety of shrimps and crustacea were secured. All along the coast as far as Franklin island a very fine coral was found.

Insects.—Perhaps the most remarkable biological discovery is the finding of insects of three distinct types. They were found in the lichen. Although very minute they are easily distinguished by the naked eye as they move about in the lichen. Their presence naturally indicates an average temperature in the locality in which we found them, not varying greatly from that observed by us.

Vegetation.

Besides abundance of the lichen which I discovered in 1894, we now found five different kinds of lichen, including the ordinary reindeer moss. Specimens were obtained as high up as 3000 feet, and as far south as 78°, at the foot of Mount Terror. On the coast, from Cape Adare onwards, seaweed of many different kinds was found in large quantities.

Meteorology.

The following is an outline of the meteorological and magnetic observations taken by the expedition in southern latitudes. The observations being still unreduced, it is impossible to discuss them fully at present, and for this reason no readings of the barometer can be given in this report. These meteorological observations were taken at Cape Adare in lat. 71° 18′ S., during an entire year, from February, 1899, to February, 1900. They were conducted on nearly the same lines as at a station of the first order, and as accurately and regularly as possible. During nine months of the year readings were taken two-hourly, from 9 a.m. to 9 p.m.; and during the three winter months, June, July, and August, two-hourly observations were made day and night. Besides these readings, and those of maximum and minimum thermometers, the self-registering instruments furnished barograph and thermograph curves for the whole period, and records of the amount of sunshine were made by the Campbell-Stokes sunshine recorder. The tables given below, although only first approximations, are sufficiently exact to indicate the general nature of the climate. Observations taken at Cape Adare are possibly affected to a certain degree by local accidents, such as the contour of the country and proximity to the sea; but the record for the year has the great advantage of being taken at one spot.

Meteorological observations were taken on board ship every two hours, night and day, during the month (January, 1899) she was beset in the ice-pack. The geographical area over which the observations were taken was between the parallels of 63° 38′ S. and 66° 46′ S., and the meridians of 160° 6′ E., and 166° 56′ E.

The mean temperature of the air for January was 29°·94 Fahr., and of the sea 29°·64 Fahr.; the mean temperature for the second week being the highest in both cases, as is shown by the following table:—

Table I.—*Weekly Mean Temperatures for January*, 1899.

	Mean temperature of air.	Mean temperature of sea.
	° F.	° F.
First week	30·2	29·8
Second week	31·9	30·1
Third week	29·4	29·5
Fourth week	28·4	29·2

The lowest temperature or the month, which occurred on the 29th, at 3 a.m., was 16°·8 Fahr. (− 8°·8 C.) in lat. 66° 45′, and long. 165° 25′ E., off one of the Balleny islands. The highest temperature for the month was 36°·4 at 5 p.m. on the 12th, lat. 65° 3′, and long. 161° 42′ E. The mean diurnal oscillation of temperature for the month was 5°·20 Fahr. The greatest range between the maximum and the minimum of one day was 16° Fahr., the least 1° Fahr.

Light and variable winds prevailed during most of the month; the force was rarely greater than 4, Beaufort's scale. Gales blew on the 9th, 16th, 22nd, and 23rd, when the velocity of the wind exceeded 30 miles an hour. The weather may be summarized as 5 days' clear bright sunshine; 13 days' snow and sleet; 2 days' rain, when the temperature rose above 32°; 4 days' mists and fogs; and the rest overcast.

As will be seen from the table given below, the mean temperature at Cape Adare is above zero for six months in the year, and for six months below zero.

TABLE II.—*Monthly Mean Temperatures.**

Month.	Mean temperature.	Date of maximum.	Maximum.	Date of minimum.	Minimum.	Range.
1899.	° F.		° F.		° F.	° F.
February	26·4†	—	—	—	—	—
March	17·7	5th	31·1	25th	− 2·5	33·6
April	10·3	2nd	30·0	19th	− 10·0	40·0
May	− 4·6	4th	23·2	13th	− 31·1	54·3
June	− 11·8	11th	14·1	3rd	− 36·0	50·1
July	− 8·6	18th	23·8	9th	− 39·9	63·7
August	− 13·4	15th	18 9	4th	− 43·1	62·0
September	− 11·9	7th	11·5	30th	− 36·1	47·6
October	− 1·8	15th	19·6	2nd	− 35·5	55·1
November	+ 17·8	28 h	45·7	1st	− 4·0	49·7
December	31·8	25th	42·2	11th	+ 20·4	21·8
1900.						
January	33·0	23rd	48 9	10th	22·5	26 4

Mean temperature for the year = 7°·05 Fahr.

August was the coldest month, the mean temperature being −13°·4 Fahr. (−25°·2 C.). The extreme minimum temperature occurred on August 4, at 9 p.m., during perfectly calm and clear weather. Table 3 shows the fall of temperature during the afternoon of that day, with the accompanying barometric pressure:—

TABLE III.

Time.	Temperature.	Temperature.	Barometer (Corr.).
	° F.	° C.	Inches.
1 p.m.	− 36·0	− 37 8	29·292
3 „	− 40·0	− 40·0	29·312
5 „	− 41·5	− 40·8	29·324
7 „	− 42·0	− 41·1	29·344
9 „	− 43·1	− 41·7	29·355

At these temperatures the mercury froze in the ordinary thermometers, and spirit ones had to be used. The above temperatures are means derived from three

* Obtained by taking the means of maximum and minimum daily temperatures.

† Based on twelve days' observations, 16th to 28th.

thermometers. At these low temperatures there was a slight diversity in the indications of the respective thermometers, even after applying the corrections as given upon the Kew certificates. The maximum temperature observed at Cape Adare, 48°·9 Fahr., occurred during a very heavy storm from the east-south-east, on January 23, 1900; but this is quite exceptional. The mean monthly temperature is above freezing-point during one month of the year, viz. January.

The relatively high mean temperature for July is due to the number of gales from east-south-east and south-east during that month, the temperature invariably rising with these winds. The extreme range of temperature was 92° Fahr., and the mean temperature for the year +7°·056 Fahr. (−13°·9 C.), which, compared to the mean annual temperature for the same northern latitude, is extremely low. The mean temperature for Lapland, in 71° N., is about 32° Fahr., and the mean temperature for the north of Spitsbergen, which extends as far north as 82° N., is about 10° Fahr.

The temperature of the sea during the greater part of the year, that is, while the surface of the sea was frozen over, remained constant at 27°·8 Fahr. In the summer months, December, January, and February, it rarely rose above 32° Fahr.

During the winter months, or at least during the seventy-one days that the sun remained constantly below the horizon, the diurnal variations of the thermometer and barometer were scarcely perceptible, being almost, if not quite, concealed by the oscillations due to the passage of storms.

The intensity of solar radiation was measured with the black-bulb thermometer *in vacuo*. This instrument was freely exposed to the sun by fixing it horizontally above the ground at the same height as the thermometer screen, viz. 4 feet 6 inches.

A temperature above 80° Fahr. was frequently recorded by this thermometer, whilst the temperature in the shade remained below freezing-point. These high readings were probably due to the hygrometric conditions of the atmosphere, the air, on account of the intense cold, being extremely dry.

Table IV. gives some of the highest readings with the solar radiation thermometer and the temperature of air in the shade observed at the same time.

TABLE IV.

Date.	Solar thermometer.	Temperature in shade.
	° F.	° F.
March 3	88·0	24·0
„ 6	92·0	22·4
„ 14	88·3	20·9
„ 16	92·2	24·5
„ 26	104·2	8·0

Relative humidity between 40 and 50 per cent.

The most remarkable feature in the meteorological conditions of the antarctic is the wind. The prevailing east-south-east and south-east winds at Cape Adare, which is within the area of abnormally low pressure, tend to prove the existence of a great anti-cyclone stretching over the polar area, which in its turn necessarily implies the existence of upper currents from the northward, blowing towards and in upon the polar regions to make good the drain caused by the surface outblowing south-easterly winds. The frequency and force of these gales, and the persistency with which they blew—always from the same direction, east-south-east—the invariably high rise in the temperature, and the sudden fall and rise of the barometer,

the dryness of the winds—the relative humidity generally between 40 and 50 per cent.—and the motion of the upper clouds from the north-west, point to the fact that the south pole is covered by what may be regarded practically as a great permanent anti-cyclone, more extensive in the winter months than in the summer. Nothing more appalling than these frightful winds, accompanied by tons of drift-snow from the mountains above, can be imagined. On ninety-two days, or 26 per cent. of the time spent at Cape Adare, the wind blew from the east-south-east and south-east with a velocity above 40 miles an hour, and on one or two occasions above 90 miles an hour, at which stage our Robinson anemometers were demolished. A proper table of wind directions, velocities, and thermal windroses is not available, but the following tables will suffice to convey some idea of the conditions.

TABLE V.—*Number of Days in each Month when Velocity of the Wind was above* 40 *Miles an Hour.*

Month.	Number of days.
1899.	
February	5
March	11
April	8
May	7
June	7
July	12
August	6
September	6
October	7
November	5
December	9
1900.	
January	9

TABLE VI.—*Conditions during a Storm on April* 2, 1899.

Time.	Barometer (corrected).	Temperature of air.	Direction of wind.	Velocity of wind.
April 1—	Inches.	° F.		Miles per hour.
9 p.m.	29·599	12·2	W.	5·7
April 2—				
9 a.m.	29·199	17·0	Whirlwinds	—
11 a.m.	29·064	22·6	E.S.E.	82
1 p.m.	28·919	24·0	E.S.E.	83
3 p.m.	28·916	26·9	E.S.E.	102?
5 p.m.	28·880	24·3	E.S.E.	88
7 p.m.	28·880	25·3	E.S.E.	90
9 p.m.	28·917	27·9	E.S.E.	82·5
April 3—				
9 a.m.	29·208	19·5	S.	40·6

The maximum temperature during the gale was 31·5° Fahr. During a gale on March 19 a Robinson anemometer was demolished, the velocity of the wind exceeding 90 miles an hour; and another was destroyed on the night of May 18, when it was impossible to estimate the velocity of the wind. The anemometers used were tested at the Kew Observatory prior to the departure of the expedition from England, and were found to give results within 97 per cent. of the Kew instruments. It is evident, however, that the action of wear and tear on the instrument by these gales must have a very material influence on its indications.

The barograph and thermograph curves during a storm from the east-south-east on May 14, 1899, show very clearly that the temperature commences to rise before the barometer commences to fall; indeed, it was often possible to predict an approaching gale by the thermometer alone, long before the barometer showed any sign of the disturbance.

The mean barometric pressure for the winter months is much lower than the mean for the summer, but the means have not yet been determined. The highest barometric pressure occurred on July 22, 1899, when the barometer registered 30·182 inches, and the lowest, 27·860 inches, on September 9, 1899.

On the journey from Cape Adare southwards, some remarkably low temperatures were observed for the time of the year. Thus, off Mount Erebus on February 11, 1900, the temperature sank to −6° Fahr. with a wind from the south straight off the great ice barrier. Again, on February 19, the minimum temperature was −12° Fahr. (−24°·4 C.) with clear sky and light wind from the south. It is possible to form an idea from these temperatures what one would be likely to encounter in the way of cold on a sledge journey southwards from the edge of the great ice barrier in the middle of the antarctic summer.

Magnetism.

Magnetic observations taken in the vicinity of the south magnetic poles will always present great difficulties, unless taken on board ship at some distance from the coast-line, and with instruments of the nature of the Fox circle. The highly magnetic character of the rocks of the shores of Victoria Land not only renders the taking of magnetic observations extremely difficult, but the observations are themselves untrustworthy. Even far inland, where the ice-cap is some thousands of feet thick, the influence of the rocks, if magnetic, as is most probable, would certainly be felt. Under such circumstances, the unifilar magnetometer is the worst instrument that could possibly be taken to the antarctic regions for the determination of intensity. Besides being a most delicate instrument, and therefore difficult for transport across ice, it is heavy, inconvenient to manage in a cold climate, and most sensitive to any form of disturbance. The ordinary dip circle, fitted with Lloyd needles for the observation of total intensity, would possibly be the best instrument to use for isolated observations on shore; whilst differential instruments fitted up in a small house built expressly for the purpose, and erected in Wood bay, would doubtless be of considerable value, although the erection of the instruments would involve much trouble. A detailed magnetic survey of Victoria Land would, of course, be of immense value—of infinitely greater value than the determination of the spot where the needle stands vertical. In order to make such a survey, it would be necessary to take a number of observations surrounding the magnetic pole. The work would have to be done during the summer months by careful and determined observers, who must be fully prepared to meet with innumerable difficulties, and be physically capable of wrestling with them.

The magnetic observations taken at Cape Adare during 1899–1900 involved the three elements, declination, inclination, and intensity, and were conducted in an open Lapp tent with great personal inconvenience, sometimes even at a temperature of −25° C. This tent was situated at a distance of about 2000 yards from the base of a volcanic and highly magnetic range of mountains, which undoubtedly had considerable influence upon the magnets. The disturbances due to the occurrence of the aurora were also very great, so that very few of the observations taken with the unifilar magnetometer are entirely free from its influence. On account of the weak

horizontal intensity in the deflection observations for the moment of the vibrating magnet, distances 39 cms. and 52 cms. had to be used instead of 30 cms. and 40 cms., and as we had no correction to our deflexion bar for these distances, it was not possible to reduce the observations on the spot. In the vibration observations, every third transit was observed instead of every fifth, and in many cases it was impossible to observe torsion of the suspension thread on account of the agitation of the magnet. The horizontal force derived from a single observation taken on May 11, 1899, assuming errors at 39 cms. and 52 cms. to be the same as at 40, was 0·04086 C.G.S., dip at the same time being −86° 35′ 20″ and declination 55° 46′ 55″ E. at 5.30 p.m.

The mean of some forty dip observations taken at Cape Adare gives −86° 34′ 13″, while the mean of some eighty declinations gives 56° 2′ 0″ E. The diurnal variations of the magnetic conditions at Cape Adare appear to be very great, but the sudden and relatively large disturbances make the determination of the normal daily variations a difficult matter. Although it is not possible to eliminate errors due to the influence of magnetic rocks, one may presume them to be constant.

On April 10, 1899, the declination was observed every twenty minutes right through the twenty-four hours. The maximum declination occurred at 4.5 a.m., and the minimum at a little after noon, the difference between maximum and minimum being 3° 2′ 5″. Again, on January 2, 1900, declination was observed every fifteen minutes. The maximum occurred at 6 p.m., and the minimum a little after noon; the difference between maximum and minimum being 1° 38′ 10″. The change in declination takes place in long oscillations or system of pulls from fifteen to twenty scale-divisions to right and left of the centre, the interval of time being rather irregular. In order to give an idea of a disturbance, the following is an extract from the Magnetic Journal:—

"*November* 29, 1899.—Impossible to take set of magnetic observations, on account of the extraordinarily disturbed state of the magnets. Vibration magnet drawn as much as twenty and thirty on each side of the central division, and the whole scale would disappear from the field of view. At 4.10 p.m. the circle reading for declination was 157° 44′ 50″; at 4.17 it was 156° 32′ 30″, the magnet being in the same position (erect) for both readings. Thus there is a difference of 1° 12′ 20″ in the declination for an interval of 7 minutes. The utter impossibility of taking observations under such conditions is obvious."

TABLE VII.—*Magnetic Dip at Eight Geographical Positions.*

Date.	Latitude.	Longitude.	Dip.	Remarks.
1899.	° ′	° ′	° ′ ″	
January 2 ...	63 41 S.	160 16 E.	−83 18 53	Taken in the ice-pack.
„ 3 ...	63 40 „	160 36 „	−83 7 41	„ „
March to Feb. 1900.	71 18 „	170 9 „	−86 34 13	Mean of 40 (Cape Adare).
February 4 ...	73 17 „	168 31 „	−87 18 28	14 miles due west of Colman island.
„ 6 ...	74 23 „	164 3 „	−88 1 31	Taken at foot of Mount Melbourne.
„ 8 ...	75 18 „	163 32 „	−87 47 15	Taken on the ice-barrier.
„ 8 ...	75 42 „	163 29 „	−87 34 51	„ „
„ 9 ...	76 12 „	168 20 „	−86 52 13	On Franklin island, west side.

Sir James Clarke Ross, in 1841, observed a dip of −88° 24′ some 12 miles to the north of Franklin island, so that the decrease in fifty-nine years amounts to 1° 32′, or an annual decrease of 1′·56. There is very little doubt that the magnetic pole is much further north and west than in 1841.

The Aurora Australis or Polaris.

The aurora, as is well known, is a phenomenon at the same time cosmic and terrestrial, which on the one hand is confined within the atmosphere of our globe, and stands in close connection with terrestrial magnetism, and on the other hand is dependent on certain changes in the envelope of the sun, the nature of which is as yet little known. At Cape Adare, which is probably within the circle of greatest aurora intensity in the southern hemisphere, particularly favourable opportunities are afforded for its study. During the cold months the atmospheric conditions are most favourable, the amount of cloud being small. During the winter the phenomenon was observed nearly every night, so it was possible to establish the diurnal period, for it usually manifested itself between 6 p.m. and 3 a.m., its maximum intensity being generally reached between 8 and 9 p.m. Of course there were exceptional cases. The intensity also appears to be much greater at the time of the equinoxes than during the mid-winter months, the displays being more brilliant and more rapid in motion at the former time. At Cape Adare (lat. 71° 18′) the aurora was always observed in the north, never in the south, and it always manifested itself in exactly the same manner. Diffused aurora light would first appear in the north about 3° above the horizon; soon afterwards a gigantic luminous arc would form above the diffused aurora, the extremities resting on the horizon, while the apex was situated a little to the west of the magnetic meridian.

The luminous arc generally formed the starting-point for the radiant draperies of rays, of variegated colours and with indescribably beautiful and graceful folds, which moved laterally and most rapidly from east to west, and bodily towards the zenith. Long shafts of light would shoot down towards the earth with incredible rapidity, the colour being of a much deeper red at the lower part of these shafts than at the upper. The intensity of the colour appears to have some connection with the altitude of the phenomenon, varying greatly with the density of the atmosphere. In other words, the colour of the aurora beams is an indication of its height above the surface of the earth, being deep red at a low altitude, and of a pale nebulous whiteness at great altitudes. But what was of greatest interest in the observation of the aurora was the connection which appeared to exist between it and an approaching atmospheric disturbance. A strong gale from the south-east was almost invariably preceded by a most brilliant and rapid aurora display. This was not a mere coincidence, but a fact repeatedly observed. It was also possible to predict an approaching storm many hours beforehand by the extreme agitation of the magnetic needle, both possibly being manifestations of the same cause.

As mentioned before, the immense influence of the aurora upon the magnetic needle made the taking of magnetic observations extremely difficult. In order to form an idea of the extent of these disturbances, the table on the following page is given, showing the relative position of the aurora in the sky observed simultaneously during an aurora display of very weak intensity.

During the appearance of the aurora the disturbance of the magnet lasted more than one hour. At no time was it brilliant or rapid in its movement. It was of quite an ordinary type as seen nearly every night. When it moved towards the west the disturbance appeared to be greatest. At times the aurora was fairly strong, but concentrated near the magnetic north. The needle was but little disturbed when the aurora became diffused.

May 31, 1900.—

Astronomical time.	Temperature. C.	Scale-div.	Value in arc.	Remarks.
H. M.	°		′	
6 45	−8·3	40·0	80·0	Magnet in meridian and steady. At 6.50 diffused aurora in north.
7 0	−7·8	47·5	95·0	Aurora becoming brighter, magnet oscillating between 47 and 48.
7 7	—	52·0	104·0	Beam of aurora shot up towards zenith, and magnet moved to 52.
7 10	—	53·8	107·6	Aurora becoming much brighter in magnetic north.
7 12	—	56·0	112·0	Beam shot up from arc towards zenith.
7 15	—	57·5	115·0	Aurora arc from north by east to west (magnetic).
7 18	−8·0	58·0	116·0	Aurora stronger, curtain of aurora with slow motion.
7 22	−8·0	52·0	104·0	Arc and curtain in north and north-west becoming faint.
7 25	−8·7	55·0	110·0	Aurora arc becoming stronger in north-west.
7 27	−9·1	50·0	100·0	Aurora faded away in west.
7 30	−9·8	47·0	94·0	Becoming diffused.
8 0	−8·8	42·0	84·0	No sign of any aurora.

The following are extracts from the Meteorological Journal:—

May 6, 1889.—Very fine Aurora Australis first visible at 6 p.m. in the form of an arc of light in the north. The centre of the arc was about 3° above horizon, and bore about north by east. The arc was of large radius, the inner side or base being of much greater intensity than the outer; much yellow and red in the base part. Curtains of vertical beams of light, always parallel to the original arc, commenced to move slowly and bodily towards the south. The lateral movement was very rapid, and always east and west, and the bottom part of the beams denser and redder than the top. The curtains of light advanced no farther than about 15° north of the zenith, the limit in the east being the planet Jupiter and in the west the star Sirius. As the curtain of light moved south, the original arc became diffused but stationary, and had little movement. The display reached its greatest intensity at about 6.30 p.m. and ended at 7 p.m. A kind of diffused after-glow remained in the north for many hours. Temperature of air = 12° Fahr; barometer, 29·262 inches.

August 4, 1899.—An aurora was observed at a little before 6 p.m. in the form of a double luminous arc in the north. The arcs were separated from one another by about 2°, the inner one being about 8° above the horizon. The west extremity of the arc bore about north-north-west. The east extremity was invisible, being hidden behind the cape. The arcs lay in the same plane, and had a common centre. Winding curtains of aurora afterwards manifested themselves in the usual way, moving towards the zenith and forming coronæ there. Temperature of air − 41·5° Fahr; barometer, 29·200 inches.

Before the reading of the paper, the PRESIDENT said: At the International Geographical Congress in 1895, I had the pleasure of welcoming Mr. Borchgrevink on his return from his first voyage to the antarctic regions. From that time until Sir George Newnes undertook to send out an expedition under Mr. Borchgrevink, he worked incessantly—I will not say obstinately, but unflinchingly—to get an

expedition sent out under his command, and he succeeded. Last year we all thought of him and his gallant companions who were trying a great experiment, for they were the first men who ever wintered on land within the antarctic circle. In speaking of them then, we expressed our warmest sympathy for the zeal and determination they had shown in facing so many hardships and dangers in the cause of science. It must have been a relief to Sir George Newnes, who had undertaken a great responsibility, when he received a telegram to tell him that Mr. Borchgrevink and his companions had finished their work, and that they were safe. We all rejoiced, and are glad to welcome Mr. Borchgrevink here this evening, after having done his very best to secure the results for which the expedition went out, and with a large measure of success. I now request Mr. Borchgrevink to address the meeting.

After the reading of the paper, the following discussion took place:—

Captain CREAK: I should like to ask one question, as I hear the expedition located the south magnetic pole. According to our present knowledge, the magnetic pole is 400 miles from where Mr. Borchgrevink wintered, as determined by the observations of Sir James Ross in 1840–45. Prof. Gauss, in 1840, by calculation, located it about 100 miles from that position. I should like to ask Mr. Borchgrevink where he places the pole now. From investigations resulting from the *Challenger* Expedition, we have been shaken in the idea that the magnetic pole moves round the geographical pole; we have begun to doubt it, and it is almost impossible that the magnetic pole, as placed from Sir James Ross's observations and others, can have travelled 400 miles in forty years. This pole is an area, not a point, and the only possible means of fixing it is as magneticians have agreed —to observe at points surrounding its supposed position. We cannot make the deductions from the few observations, I suppose about a dozen, made in a limited area on the ice or land. He does not state definitely what his observations at Cape Adare were—whether they were differential observations, or absolute observations; he also does not tell us whether the aurora had any effect on the magnetic instruments. There is a doubt, from what he says, as to whether the locality he examined is not disturbed magnetically; I am not aware that he has given information on that point. I have not heard yet that the ship was utilized to take observations at sea, where they would have been free from local magnetic disturbances. We know from our surveying vessels that the dip differs 30° from the normal at Cossack, in North-West Australia, and I am sorry the *Southern Cross* was not taken out to sea for observations free from local disturbance. I do not know how far from the shore he took his observations on ice. I should again, therefore, like to ask him where he places the magnetic pole now, and whether determined by observation.

Mr. BORCHGREVINK: The approximate position of the south magnetic pole, according to the calculations of my observers, is 73° 20′ S. and 146° E. I did not know that the magnetic pole ever changed round the geographical pole. I believe the observations we were able to make from Coulman island and southward give us information sufficient to justify us in determining the south magnetic pole to be 73° 20′ S. and 146° E. It differs somewhat from the admirable work of Ross and the theoretical work done by excellent men in Europe, but we know the pole is not stationary. We have reason to believe that these observations made away from the vessel on the ice rather far from the shore, where less local attraction will occur than on the land itself, are under the most modest computations reliable, and a great support to these results is the admirable work done by Prof. Neumayer of Hamburg, whose figures almost coincide with the very excellent magnetic observations of my staff. It is important that a continuous series of magnetic observations

should be carried on at South Victoria Land, as magnetic events once missed we will never be able to work up to again, because what is past is lost, is a missing link, and I, as leader of this expedition, must use my influence to urge on to lose no time. Another expedition must follow in our steps, to add links to that chain which we have been able to pick up from my predecessor, Sir James Clarke Ross.

Admiral McCLINTOCK: I wish to ask one very practical question—whether, in Mr. Borchgrevink's opinion, we could reasonably expect a steamer to visit Victoria Land, and if she reached there, whether she would find his huts in a habitable condition?

Mr. BORCHGREVINK: I went there once as a sailor before the mast, next time in command of an expedition; on both occasions we were able to get to Cape Adare. In 1898 I found the summer season a little bit later than on my first visit. For a well-fitted vessel with good engines the chances of landing are very great, especially if a course is taken east of 170°; and I believe, under an able leader, which a national expedition naturally would have, that it could be done, and they will be able to carry on the able work of the illustrious Sir James Ross, who worked without the aid of steam. But with steam I think new difficulties arise. I think in a steam-vessel a very important feature is a well to change the propeller without going into dock. There should be two vessels, as I felt if the *Southern Cross* had been crushed we would have had to wait a few years before any one took us off.

The PRESIDENT: In thanking Mr. Borchgrevink for his paper, I think we may sum up with the conclusion that the expedition has done a very interesting and important piece of work. He selected Cape Adare as the place for wintering, and making his efforts at exploration. It appears now that it is practically impossible to penetrate into the interior at Cape Adare, because I suppose that the great mountain range approaches closely to the sea and terminates in cliffs and glaciers broken by enormous crevasses, and it would not probably be practicable for any sledge party to go inland for any great distance. We find from the paper he read that he made many desperate and determined efforts to penetrate inland, but found it impossible. Nevertheless the work that was done at his winter quarters is very important. I think it will be found that the meteorological observations have been taken with great care, and will be extremely valuable, extending over a whole year. The natural history collections are interesting, and some of the specimens, especially the fish and the mollusca, are, I understand, quite new to science. Therefore we have to thank Mr. Borchgrevink, although he was unable to penetrate into the interior, for having done valuable work during the year at Cape Adare. I gather from the paper that he made one attempt to explore the coast to the westward. He also appears to have found that impracticable, and did not get any great distance. To me and most geographers, by far the most important work was done during the period when he was able to land on the great ice-barrier, although I was astonished to find the difference in latitude between Sir James Ross and Mr. Borchgrevink is nearly 36 miles. Now, assuming all the observations to be correct, that can only be accounted for by the barrier having broken off to that extent and formed a bay during a period of 60 years. It is also interesting to know that the landing can be effected on what hitherto we have believed to be continuous cliffs 400 miles in extent. If Mr. Borchgrevink had had more time he might have gone a greater distance to the south. It would appear, from what he says about the places for winter quarters that exist inside Coulman island and at Newnes land, that hereafter the continent may be penetrated by sledges on the principles adopted by McClintock, and important discoveries may be made there. We must thank Mr. Borchgrevink and his staff for the extremely valuable scientific work done at Cape Adare, and for giving us further information about the ice-barrier.

In asking you to pass a vote of thanks to Mr. Borchgrevink for his paper, which is an extremely interesting one, and for his excellent series of photographs, I would also wish to include the members of his staff present here this evening, who have worked so hard and done so excellently in their different departments; and I think we cannot forget Sir George Newnes, who, through his munificent generosity, enabled this work to be done. I now propose a vote of thanks to Mr. Borchgrevink, his staff, and Sir George Newnes.

STUDIES IN THE ANTHROPOGEOGRAPHY OF BRITISH NEW GUINEA.*

By Prof. ALFRED C. HADDON, Sc.D., F.R.S.

With regard to the Gulf natives, we may safely regard the short, very dolichocephalic people of Maipua as belonging to a primitive stock. The skulls from the Purari river, which is the same district, have a somewhat higher average index (72 to 73) than the six Maipua men measured by Chalmers (70). Perhaps the skulls are those of enemies taken in battle. The Orokolo and Toaripi people may be regarded as belonging to one group; their cephalic index on the living subject may be taken as 77. They are tall men—1·677 metre (5 feet 6 inches) for the former, and 1·702 metre (5 feet 7 inches) for the latter; but the Rev. J. H. Holmes has measured the stature of twelve Orokolo men, and obtained the high average of 1·715 metre (5 feet 7½ inches)—min. 5 feet 3 inches, max. 5 feet 11 inches. Bevan refers to the high stature of the men on the Aivei (Purari river). He says, "Some would measure at least 5 feet 10 inches (1·778 metre) in height," and states that they approximate to the Toaripi.

Up the Fly river, well in the interior, there is a decidedly dolichocephalic population, which Mantegazza and Reglia have shown to be craniologically allied to the Geelvink bay natives; but even high up the Fly river there are traces of brachycephalism. This is well marked in its delta, where a mixture of peoples has taken place. Some of the inland or "bush" tribes are certainly of the ordinary dolichocephalic type. These appear to be pressed back by a mesaticephalic or low brachycephalic people, who have established themselves at Canoe island, Kiwai, Oriomo, and probably at other places on the coast of Daudai, as I measured a Parama man with an index of 77·2, and a Mawatta man with one of 80.

Torres strait is inhabited by a dolichocephalic people, which has probably remained pure in the eastern group—Erub (Darnley island) and Mer (Murray island), but the western islands appear to have been overrun by a more or less brachycephalic people, who are doubtless of the same stock as those who have occupied the adjacent coast of New Guinea and the delta of the Fly river.

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* Continued from p. 291.

These facts can be seen at a glance in the following table:—

Length-breadth index of skull.	Interior, Fly river.	"Bush-men," Daudai.	Kiwai.	Oriomo.	West tribe, Torres strait.	East tribe, Torres strait.	Total.
-73·9	16	10	1	—	33	25	85
74-75·9	3	1	1	—	8	4	17
76-77·9	2	3	4	1	3	4	17
78-79·9	—	—	2	2	9	—	13
80 + ...	—	—	4	—	11	—	15
Total, male and female ...	21	14	12	3	64	33	147

So far as I have had time to work it out, the available anthropometric evidence appears to me to warrant the following conclusions; but, in all fairness, I should say that I do not consider that sufficient material has as yet been collected to enable us to form otherwise than tentative hypotheses. I am aware that Dr. Loria has made numerous measurements in British New Guinea, but these have not yet been published, and I have not had time to calculate and tabulate all our own measurements; probably the cranial height, facial, nasal, and naso-malar indices will throw more light on the problem of the distribution of people in British New Guinea.

There appears to be, in the central range, a low brachycephalic people of rather short stature, who harry the short dolicho- or mesaticephalic hill tribes. In certain places they seem to have burst through this somewhat dolichocephalic zone and to have reached the coast. In the Mekeo district this movement is completed, but in the Rigo district the mountaineers are forcing the hill tribes towards the coast, which they themselves do not appear to have yet reached, although they are very close to it. In the central district they have devastated the hill tribes, and in one of their recent raids they came within a few miles of Port Moresby.

There is a dolichocephalic or subdolichocephalic population, which is usually above the average in stature, all round the Papuan gulf. At the eastern end the indices are mesaticephalic, and the stature is remarkably high for Papuans. At Maipua the stature is much lower, and the cephalic index extremely so.

The whole of the Fly river district, including Daudai, appears to be dolichocephalic with distinct traces of low brachycephalism, which appears to be especially strong in the delta of the Fly river. The brachycephals have invaded the western islands of Torres strait, where they appear to have amalgamated with the previous dolichocephalic population, but this movement has not extended to the eastern islands.

The dolichocephals, distributed over the whole of New Guinea and

the adjacent islands, may belong to one ethnic group which has developed along various cultural lines in different places.

The problem of the brachycephals does not appear to me to be anything like so simple. One result of the Cambridge Expedition has been to establish a low brachycephalic population on the western slopes of the central range. Some of these are decidedly short; but, on the other hand, Macgregor speaks * of the natives of Gosisi and Tobiri at the foot of Mounts Knutsford and Musgrave, on the upper reaches of the Vanapa river, as "the best-built men yet met with in this colony. In the gulf, for example, there are as tall men, but they are greatly inferior to these mountaineers in general muscular development, especially in the lower extremities. There was no straight or wavy-haired individual there." We do not know what shaped head these people have. There is no reason, so far as I am aware, to believe that they are otherwise than an autocthonous population. The same may be said for the brachycephals in the Fly river district.

Having been struck by the differences between certain crania from Tud (Warrior island, Torres strait) and those from Erub, Sir William Turner † suggests: "it is not unlikely that these islanders may have had a large admixture of Malay blood." As there is no trace whatever of Malay physical character, culture, or language, this theory does not appear to me to be adequate, and for the present I do not seek outside of New Guinea for the ancestral stock of these people.

The coast brachycephals of the Motu stock—for example, the Bulaa folk—belong to quite a different category. So far as I am aware, the characteristic frizzly hair of the Papuans is universal among the mountain group of brachycephals, but in the Rigo district,‡ and strangely also to a less extent in the Mekeo district, great variation prevails as to the nature of the hair. I have collected every variety, from straight, through wavy and curly, to the most pronounced frizzly or woolly. The Motu people admit they are immigrants.

Finally, there are the brachycephals of Murua, the D'Entrecasteaux, and China strait. The cultural evidence points to their being of a different stock from the Motu. I have elsewhere § spoken of this ethnographical region as the Massim district; hence these broad-headed people may be termed the Massim brachycephals.

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* 'Annual Report, British New Guinea,' 1899, p. 12.

† *Journ. Anatomy and Physiology*, xiv., 1880, p. 485.

‡ We understood that the boy photographed by Mr. Wilkin (p. 270) belonged to the Sinaugolo tribe. If this tribe came from the interior I do not understand how the wavy hair is present; certainly we saw several other examples in the villages near Rigo. Perhaps the Sinaugolo originally migrated up the Vanigela from the coast, and then returned towards the coast in a westerly direction.

§ 'The Decorative Art of British New Guinea,' *Cuningham Memoir*, x., Royal Irish Academy, 1894.

Dr. A. B. Meyer has recently published a translation,* with additions, of two chapters of his great monograph on the Negritos of the Philippines. This critical and cautious essay is a needed correction to loose generalizations, and I can scarcely hope to escape from the criticism of my learned friend, as he considers that "the question whether the Papuans are a mixed race or no is not yet ripe for decision." He himself inclines to the view of the variability of the race as the simplest hypothesis, and as provisionally sufficient. Further, Sir William Macgregor, the late Lieut.-Governor of British New Guinea, who has a unique knowledge of the natives he has so successfully ruled, also rather deprecates an ethnological analysis of the people. On the other hand, it is difficult to make advance in a subject if working hypotheses are not employed. Facts must be grouped to be usable. While I candidly admit that the ethnic variation found everywhere in New Guinea can be brought forward to support Dr. Meyer's contention, I venture to maintain that, however imperfect and even transitory my hypotheses may be, they should at least serve to advance our knowledge by the grouping of facts and by drawing attention to concrete problems.

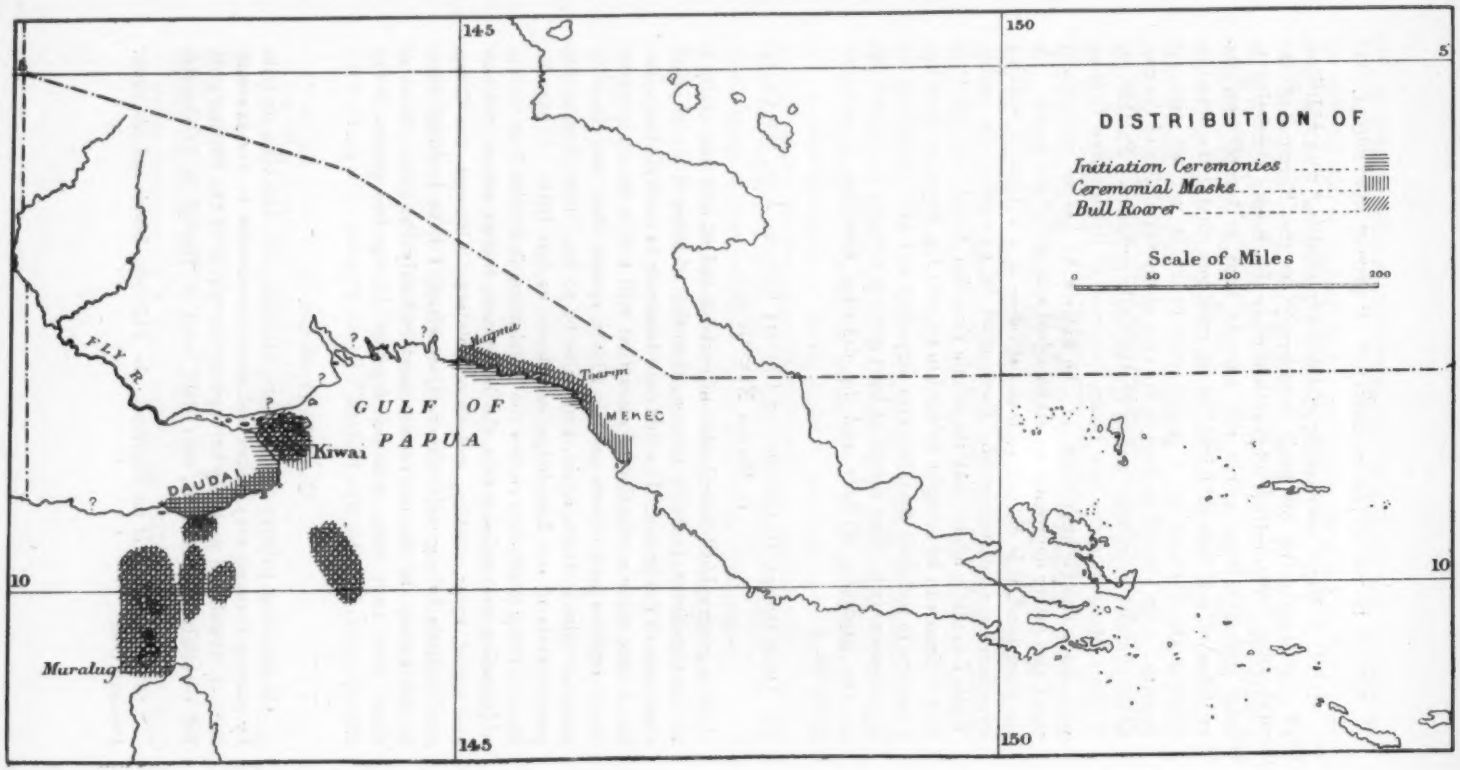
The Geographical Distribution of Certain Customs, Arts, and Crafts in British New Guinea.

The geographical distribution of customs and of arts and crafts is no less significant, probably more so, than that of some of the physical characters of the people. It would have been easy to multiply examples; but I have made a selection of cases that will suffice for my purpose. Many customs and objects are so widely spread that they have no analytic value; others, again, appear to be so local that they, at the present state of our knowledge, can teach us but little. I purpose, then, to bring briefly into review the distribution in British New Guinea of initiation ceremonies, masks, the bull-roarer, houses, canoes, the bow and arrow, spear, pottery, and decorative art. Although the Torres strait islands belong politically to Queensland, I have included them in this survey, as the natives are most certainly Papuans. Some of these facts have been collected together in my two papers, "The Ethnography of British New Guinea" (*Science Progress*, 1894, pp. 83, 227).

Initiation Ceremonies.

On attaining puberty the lads are admitted into the clan or tribe by passing through very sacred and secret ceremonies in Torres strait, Daudai, Kiwai, and probably throughout the whole of the Papuan gulf, but certainly from Maipua, near Bald head, to Toaripi in Freshwater

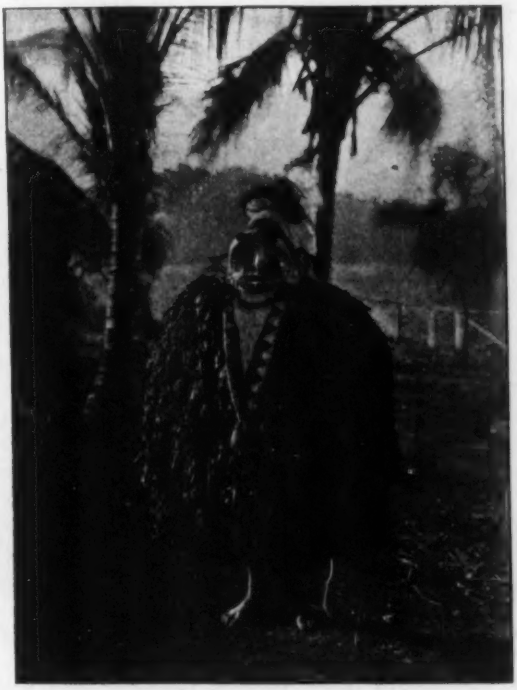
* 'The Distribution of the Negritos in the Philippine Islands and Elsewhere.' Dresden: 1899.


145
150
5
10
DISTRIBUTION OF
Initiation Ceremonies
Ceremonial Masks
Bull Roarer
Scale of Miles
0
50
100
200
FLY R.
GULF OF PAPUA
Kiwai
DAUDAI
MEREC
Muralug

bay. I have described the initiation ceremonies which took place in Torres strait, and Chalmers gives some interesting information about the Gulf ceremonies—these have been quoted by me in my 'Decorative Art of British New Guinea' (pp. 104–109); and Chalmers (*Journ. Anth. Inst.*, xxvii., 1897, p. 326) may also be consulted.

Masks.

Masks are worn during the initiation ceremonies from Torres strait



"FULAARI," OR MASKED EXECUTIVE OF THE TABOO, WAIMA, MEKEO DISTRICT.

and Daudai to Toaripi. Chalmers states that at the mouth of the Fly river a mask is worn by elderly men who have arrived at the final stage of initiation. If this takes place in Kiwai, it is, so far as I know, the only occasion on which a mask is worn in that island.

Masks are employed for various ceremonies throughout this wide area, but not beyond it to the south-east, save in the Mekeo district, where they are used in one or two places. The villages of this district are divided into two main communities, each with its own chief.

One is the usual headman, who, I believe, is the war-chief; the other is the Afu- (or tabu-) chief. It is his business to put *afu* on coconuts, areca nuts, etc., if he sees signs of failing crops. Certain members of the other community, than that to which the Afu-chief belongs, have the responsibility of seeing that the tabu is observed, and some fourteen or fifteen of these men, who are called "Fulaari," constitute a sort of constabulary. Every evening they go round the village, armed with clubs and disguised with masks, or covered up with leaves so as to be unrecognizable. At Waima all the executive of the tabu wear masks, attached to which are enormous cloaks of leaves; at Inawi and Veifaa they paint the face and cover up part of the body, but they sometimes

BULL-ROARER AND CEREMONIAL MASKS FROM KARAMA, PAPUAN GULF.

wear masks; at Aipiana they cover over the whole body with leaves. Masks are used for a similar purpose by the Toaripi, according to Chalmers.* In other words, in the Mekeo and Toaripi districts masks have a legal significance, whereas elsewhere in British New Guinea they are, so far as is known, distinctly religious or perhaps in some cases magical insignia. Parallels to this will be found in New Britain, Africa, and elsewhere. The Torres strait and Daudai masks are made of wood or turtle-shell (tortoise-shell); those of the Papuan gulf are constructed of a natural cloth, the designs being marked by cloissons of midribs of palm leaflets, and the spaces coloured black, white, and

* *Loc. cit.*, p. 329.

red. Some masks, very similar to the latter, have been obtained from Kaiser Wilhelms Land, but the cloissons are, I believe, absent; other masks from the German territory are of wood.

The Bull-roarer.

That remarkable instrument, the bull-roarer, is employed in Torres strait, the estuary of the Fly, and along the Papuan gulf. It does not appear to occur in the Mekeo district, and is absent over the whole south-eastern peninsula and adjacent archipelagoes; but it crops up again in German New Guinea. In Kiwai and the Papuan gulf it is employed in initiation ceremonies, as it also was in Muralug (Prince of Wales island), Torres strait. In the other islands it was not shown to the lads during their initiation, but was swung in fishing ceremonies, and I have recently discovered that it was also employed in Mabuiag, as it still is in Kiwai, to make crops grow. In Mer (Murray islands) it was associated with rain-making and used in a ceremony connected with turtle-fishing.

Houses.

The natives of Torres strait have adopted the oblong "South sea" type of house. Formerly the eastern tribe, the Murray islanders, and the natives of Erub and Uga, built small circular beehive huts; of these only one now remains in the Murray islands. The western tribe also built on the ground, but they had more or less oval or oblong huts, with a flat or curved gable roof, and with walls about 2 feet in height, or without walls at all; some were mere shanties or break-winds, except in Saibai and Dauan, where there were pile-dwellings. These houses were inhabited by single families.

In Daudai and on the Fly river long communal houses are built on piles from 100 to 500 feet in length. Many families live in these houses, and I recently discovered in Kiwai that each house is inhabited by members of one clan only, who all acknowledge the same totem: here a woman adopts the husband's totem. The end rooms are the club apartments of the men; the women and children enter the houses by the side doors.

Macgregor says,* among the black people of the coast of the Papuan gulf, and among the lighter-coloured tribes of the interior, it is customary in many places to have large "man-houses" for the males, and smaller "woman-houses" for the women and children. The "man-houses" are sometimes several hundred feet long; those for the women are always smaller. The former are what Chalmers used to call "temples," or *dubus;* this last is a Motu word, and he now terms them by their native name of *eramo.*

Inland the houses are generally straight-roofed, and with each end completely open. They are square or oblong.

* 'British New Guinea: Country and People' (1897), p. 85.

In the whole of the remaining portion of British New Guinea we again find family houses, which are always raised from the ground on posts, except in two widely separated localities.

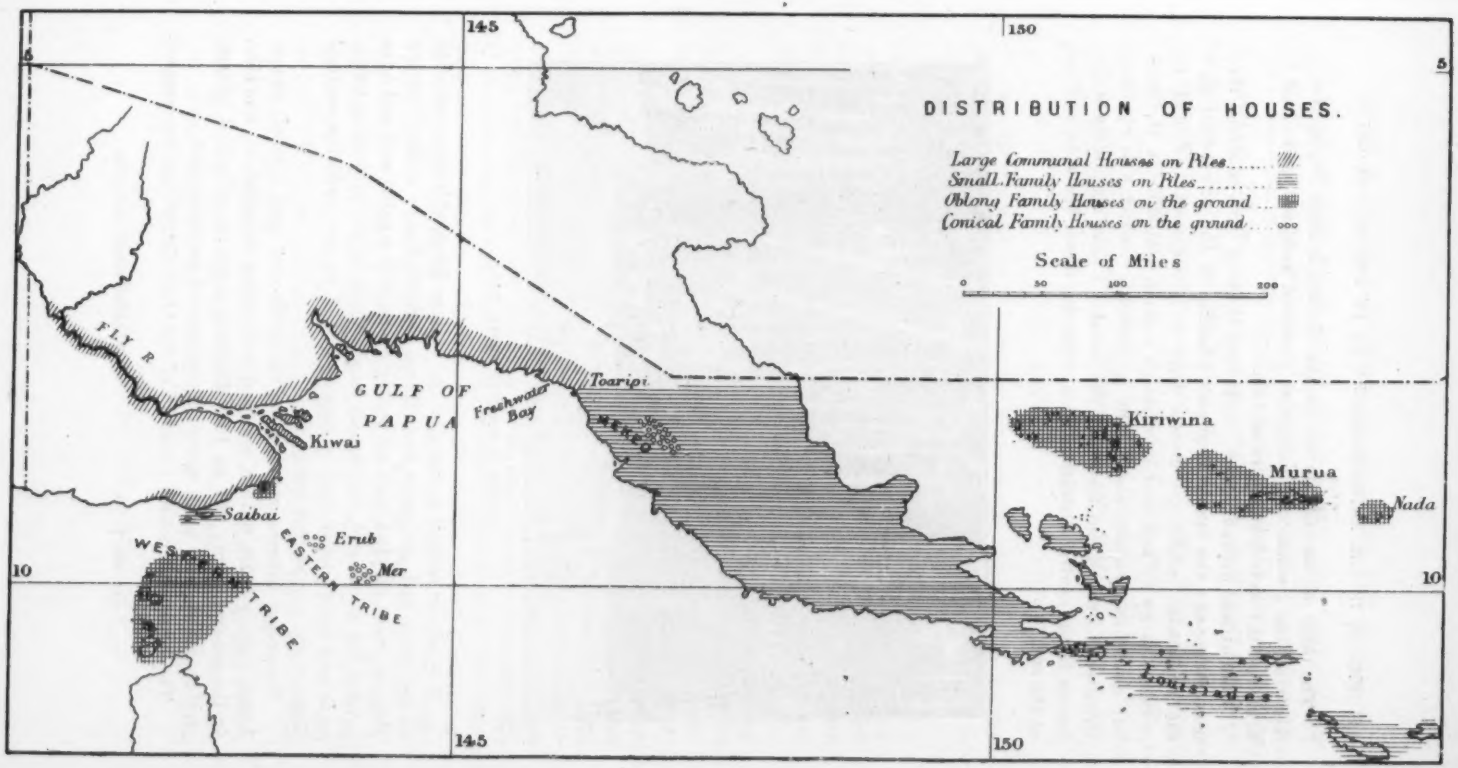
At Bubuni and Vale, villages on the top of steep hills behind the Mekeo district, and the similarly situated Emene on a southern spur of Boboleva (Mount Davidson) are conical ground houses with elliptical and circular bases. In some places, as on the Adualla affluent of the Alabule (Angabunga), these are oblong, having a short ridge-pole. Fathers Jullien and De Rijke * state that the crests of the mountains are long and straight, and the villages on some of the ridges consist of only a single street of such narrow width that two persons can only just pass;

THE LAST ROUND HOUSE IN MER (MURRAY ISLANDS).

the houses are built partly on the crest, partly on the slope, and the whole village is surrounded by a palisade. In the mountains inland from Oroi (Nara), and about the same latitude, "beehive houses" have been recorded.

Macgregor describes and figures small ground-houses with the gable roof coming right down to the ground at Neneba, on Mount Scratchley. These have a sleeping-platform close to the angle of the roof, to which access is had by a small ladder. These houses might be described as very small pile-dwellings, in which the roof is continued down the sides to the ground. In some there is a pent-roof over the entrance.

* *Comptes Rendus Soc. Géogr. Paris*, 1898, p. 206.


DISTRIBUTION OF HOUSES.
Large Communal Houses on Piles.....
Small Family Houses on Piles.....
Oblong Family Houses on the ground ...
Conical Family Houses on the ground....
Scale of Miles
0 50 100 200
145
150
5
10
FLY R.
GULF OF PAPUA
Freshwater Bay
Toaripi
MEKEO
Kiwai
Saibai
Erub
Mer
WESTERN TRIBE
EASTERN TRIBE
Kiriwina
Murua
Nada
Louisiades

The other ground-houses are in the Bennet islands (Nada, Murua, Kiriwina, etc.), where the elongated roofs are saddle-shaped—that is, higher at the ends than in the middle.

In all these ground-houses, including those of Torres strait, there is no verandah; this is also strangely wanting in the pile-dwellings of the Louisiades, where the houses have a boat-shaped roof, and the entrance is by an end door or through a small trap-door in the floor; but nearly everywhere else in the possession a verandah at the front entrance is a prominent feature of the house. I have seen some Koiari houses in the central district with a verandah down the side, and not at the end.

HOUSES IN COCONUT GROVE, NADA.

It would be tedious to describe the various forms of houses met with on the south-east peninsula from Mekeo to South Cape; suffice it to say they are built on piles, have an oblong shape with a gable roof, and have a verandah at one end, which may be sheltered by the projecting gable, or it may have a small shed or lean-to roof of its own, which sometimes forms a hip-roof at that end.

Macgregor informs us * that on the north-east coast a small square house, lightly built, with a mansard roof and a verandah on one side, is the general form; but on the Mambare there are elliptical houses, well thatched, with small square entrances and no verandahs.

The large club houses (*eramo*) † of the Gulf district are represented

* *Loc. cit.*, p. 86.

† Also called *elamo* and *erabo*.

by decorated houses (*marea*) in the Mekeo district; and further down the coast beyond Port Moresby, at Lakwaharu (Tupuseleia), Kapakapa, and in the other villages round about Rigo and in the Hood peninsula, Bulaa (Hula), Babaka, Kalo, etc., these are replaced by open-air platforms (*dubu*), the posts of which are usually carved.

The houses of the marine villages of Lakwaharu, Gaile, Kapakapa, and Bulaa, do not differ in any essential point from those on the shore.

The tree-houses of the Koiari and other hill-tribes in the central district are merely places of refuge; they are occupied only when danger threatens.

Canoes.

The distribution of the various main forms of canoes in British New Guinea has many interesting features. Everywhere the canoes are dug-outs, but sometimes a free-board is lashed on to the hull.

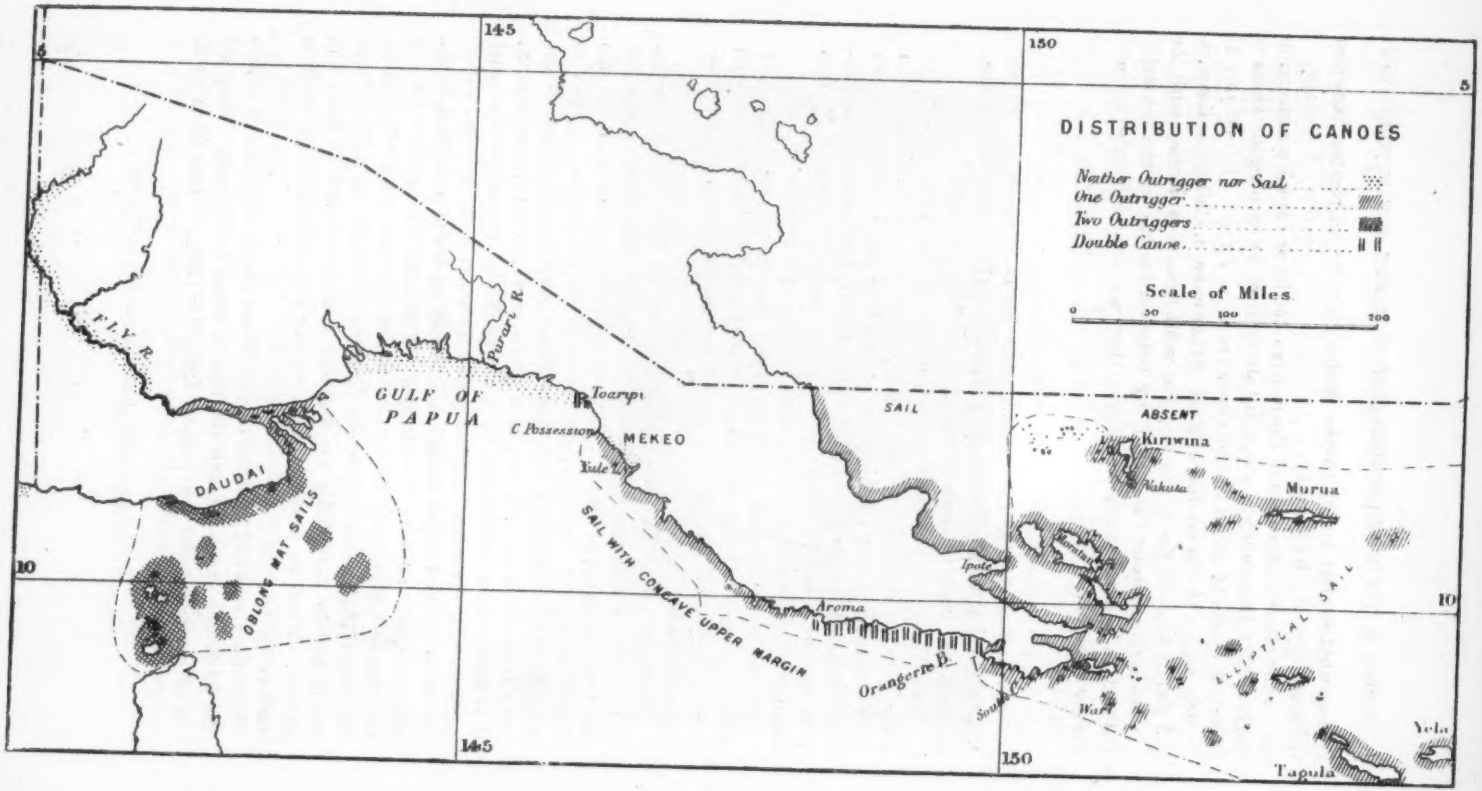
The Torres strait canoes were imported from the mouth of the Fly river, but the islanders and the Daudai coastal people furnished them with a free-board and a double outrigger. The latter consisted of two long thwart poles, to the ends of which a float was attached; a platform was built on the thwart poles in the centre of the canoe. Two large oblong mat sails were erected in the bow of the canoe.

On the lower Fly the inefficient small canoes have a single long slender outrigger at a great distance from the canoe. Their small sails are oblong mats. Up the Fly river the narrow canoes have no outrigger or sails.

Between the Fly and the east of the Gulf of Papua the sail seems to be quite unknown, and there is no outrigger. Macgregor points out that the special peculiarity in the construction of the canoe of this district is that it seems designed more to let the water out than to prevent it from entering. It has neither prow nor stern, but is cut away from above at each end in a gentle curve, so that the extremity, if it meets the water, divides it in the horizontal instead of the usual perpendicular direction. The extremes are about level with the water. At Birce, on the upper Purari, the canoes have sharp vertical, high-ended prows; there is no outrigger. The large war-canoe (*lakia*) of the Toaripi * consists of two canoes lashed together about 6 feet apart, and the bridge in the centre is a platform on which the fighting men stand, and to the railing are fastened a large number of bows and arrows. When we were at Delena we saw a similar canoe arrive from further up the coast.

In the rivers and estuaries of the Mekeo district the canoes have a flat projecting stern end, and the bow is blunt and clumsy. They are all of one piece, and are pushed along by poles. These seem to be

* J. Chalmers, *Journ. Anth. Inst.*, xxviii., 1897, p. 327.


DISTRIBUTION OF CANOES
Neither Outrigger nor Sail
One Outrigger
Two Outriggers
Double Canoe
Scale of Miles
0 50 100 200
145
150
5
10
FLY R.
Purari R.
GULF OF PAPUA
Toaripi
C. Possession
MEKEO
Yule I.
DAUDAI
OBLONG MAT SAILS
SAIL WITH CONCAVE UPPER MARGIN
SAIL
ABSENT
Kiriwina
Nakula
Murua
Iroro
Ipote
ELLIPTICAL SAIL
Aroma
Orangerie B.
South
Ward
Yela
Tagula

somewhat similar to the canoes used by the Tugeri pirates from just beyond the Dutch boundary.

All along the seaboard of the central district as far down as Keapara (Kerepunu) the canoe is generally single with an outrigger, which is lashed by many poles to the canoe; it is sharp and high-pointed at each end. The great majority of these canoes are made at Keapara. From Aroma to Orangerie bay the sailing-canoe is double, with the sides often increased in height by boards sewn on to the hard wood. From Yule island to Orangerie bay the sail has an elongated heart-shape, sharply pointed at one end, and with a deep crescentic notch at the other.

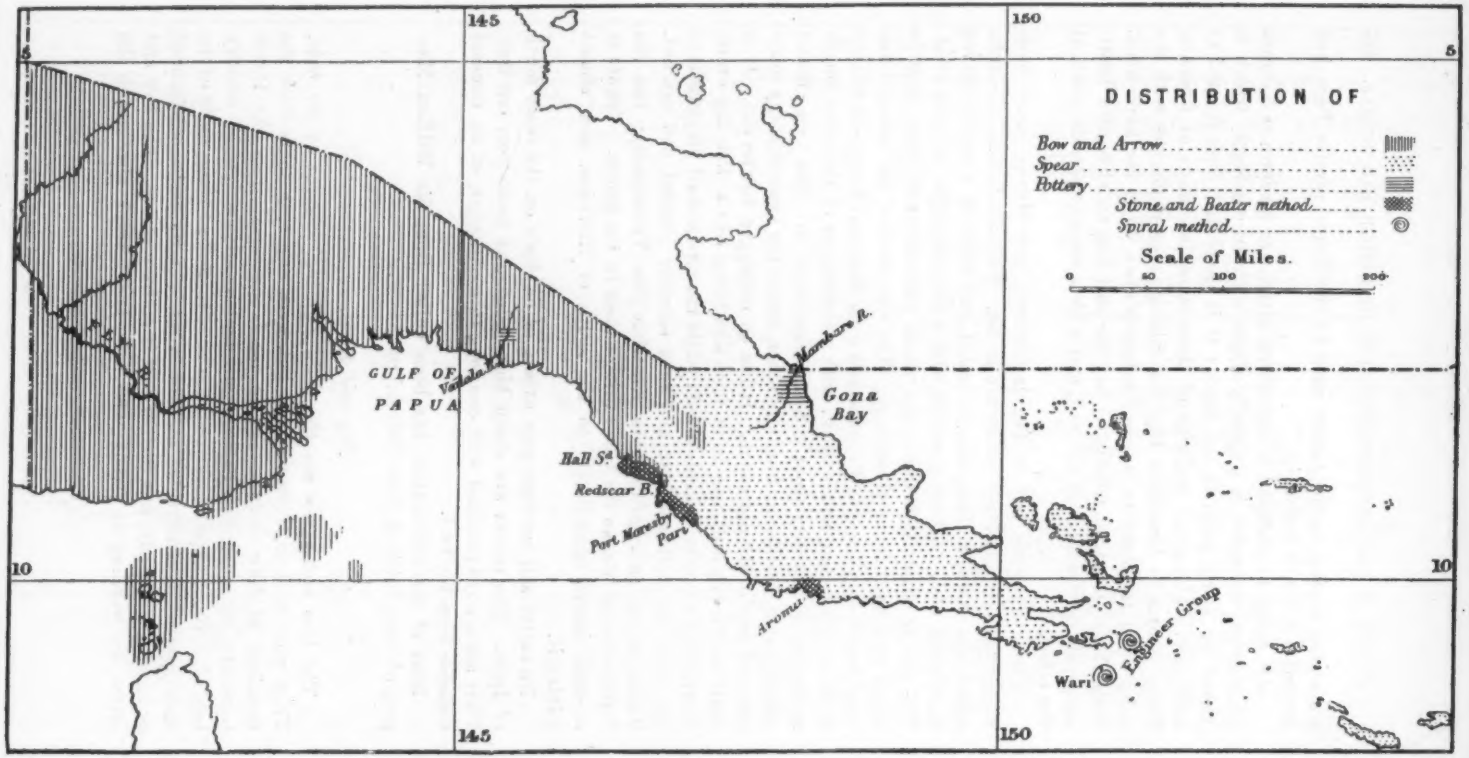
From Orangerie bay to Tagula (Sudest), and Murua, much more handy and skilfully-made canoes are in use. They are formed of boards, which are sewn, caulked, and decorated, and built on a strong curved hard-wood keel. All are provided with a long outrigger of light wood. The sail is elliptical in form, the whole circumference being kept in shape by a light frame of saplings. The war-canoe of the east end was used from South Cape to Tauputa, and from Moratau (Fergusson island) to Wari. It is long and narrow, with an outrigger of the same length as the canoe, and only about 2 feet distant from it. The Yela (Rossel island) canoe is different from any other, and is the most skilfully made canoe of any in the possession. It has an outrigger, but no sail. It is built up from a hull, and is in form something like a Rob Roy canoe, there being a central walled-in well, while the fore-and-aft projections of the hull are hollowed out and then securely boarded and caulked. There are no sailing-canoes in Kiriwina (the Trobriands); but the Vakuta people possess the best sailing-canoes in the group. Vakuta is a small island immediately to the south of Kiriwina, and almost joining it.

No native sail has been seen at sea or on shore on the coast north of Ipote. The canoes are sharp, high-ended, and made from one tree. They are always provided with one long thin outrigger, at an unusual distance from the hull.

Most of this information has been culled from Sir William Macgregor's book 'British New Guinea,' pp. 54–59.

Bow and Arrow.

The bow and arrow are the main fighting weapons of the west. They were used in Torres strait, but were imported there from the mainland of New Guinea. Their use is universal from the Dutch boundary, all along the Papuan gulf, and in all the interior country behind. About Cape Blackwood, the bow, instead of being made of the male bamboo, is constructed of palm wood, and its use once extended as far as Redscar bay, but further east it entirely ceased. The bow and arrow are wanting at Babuni and Vale, and I think also among the


145
150
5
10
DISTRIBUTION OF
Bow and Arrow
Spear
Pottery
Stone and Beater method
Spiral method
Scale of Miles.
0
50
100
200
GULF OF
PAPUA
Vanapa R.
Kemakore R.
Gona Bay
Hall Sd.
Redscar B.
Port Moresby
Port
Aroma
Wari
Engineer Group

Uni Uni, who live on the southern spurs of Mount Boboleva (Mount Davidson) at the back of the Mekeo district. They are, however, employed a little lower down the central mountain range; but here they are by no means the formidable weapons they are in the Papuan gulf—for example, at Neneba on Mount Scratchley the bow is of palm wood, is weak, and about 3 feet long, with a string made of a strip of cane; the arrow has a reed shaft and a wooden point without barbs. The bow and arrow have not been seen on the lower Mambare, nor do they appear to occur in the main range south of the Scratchley *massif*.

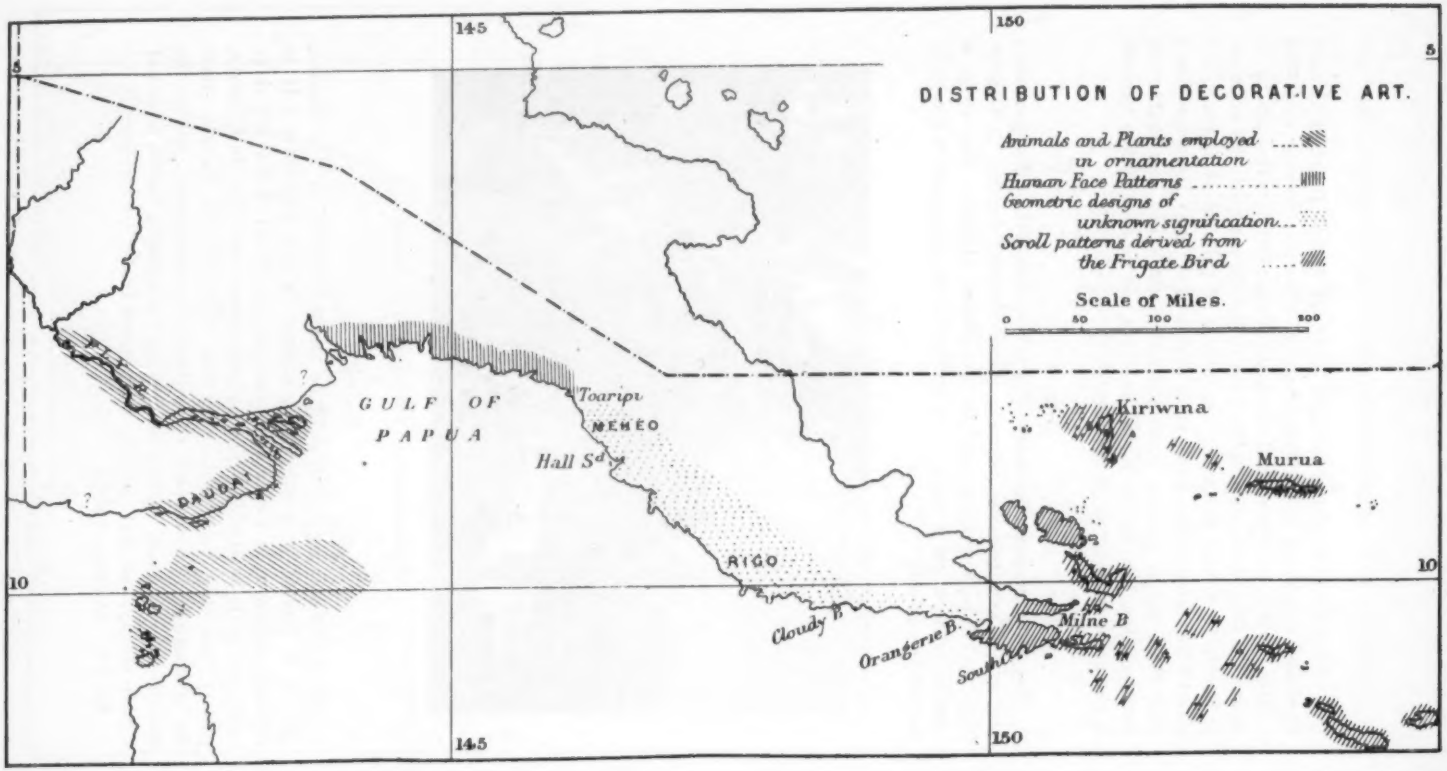
Spear.

The spear replaces the bow and arrow in the rest of the peninsula and in the archipelagoes beyond. These weapons overlap in Redscar bay, the Kabadi country, and in the Mekeo district. The spear is usually made of palm wood; it is always in one piece, and is generally barbed on one side.

POTTERY-MAKING AT HANUABADA, PORT MORESBY.

Pottery.

The art of making pottery is by no means universal in New Guinea, and it is limited in a suggestive manner in the possession. It is entirely unknown in Torres strait and in the whole of the Fly river basin and to the west of it. Throughout the whole of the Gulf district pottery has only been met with some way up the Vailala river. No information is given as to the method of manufacture; but, as the articles are very rude, we may assume they are simply fashioned out of a lump of clay, and that probably a stone and beater are employed.


DISTRIBUTION OF DECORATIVE ART.
Animals and Plants employed in ornamentation
Human Face Patterns
Geometric designs of unknown signification
Scroll patterns derived from the Frigate Bird
Scale of Miles.
0 50 100 200
145
150
5
10
GULF OF PAPUA
Toaripi
MEHEO
Hall Sd
RIGO
PAUDA
Kiriwina
Murua
Milne B
Cloudy B
Orangerie B
South
145
150

No interior tribes of the south-east peninsula make pottery; but along the western coast the Motu settlements are the seat of a considerable pottery industry, and most coast natives can distinguish between the pottery of different villages, and even recognize the handiwork of individual women, for this is entirely woman's work. The pottery is made out of a lump of clay, which is first moulded by the hands and then beaten out by means of a wooden beater and a stone held within the pot by the left hand. Pots made in Port Moresby are exported to the Papuan gulf. Pottery is made in the villages of Pinupaka, Ziria, Delena (in the Mekeo district), Manu Manu in Redscar bay, Lealea in Caution bay, Boera, Borepada, Port Moresby, and Pari—these are Motu villages, and also by the Aroma tribe chiefly at Maopa.

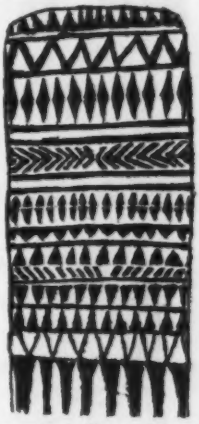
In the Engineer group, and especially in Wari (Teste island), the clay is laid down in a spiral, and no stone or beater is used, but the pot is smoothed with a Tellina shell.

The only other locality in the possession where pottery is made is near the German boundary. Thick, coarse pots, usually nearly covered with rude incised patterns, mainly zigzags, are made at Gona bay (Holnicote bay), but another style of decoration occurs at Waututu. There is no information as to the manner of manufacture of this pottery. In German New Guinea pottery is made from the lump, as among the Motu, at Humboldt bay, Dallmann harbour, Astrolabe bay, and elsewhere.

Decorative Art.

There are many interesting features in the distribution of decorative designs in British New Guinea; but as I have elsewhere* dealt so fully with this subject, I need not do more than point out the salient features.

On referring to the sketch-map, it will be seen that I distinguish four main districts, which may be designated as the Western, Gulf, Central, and Massim or Eastern regions. These can be further subdivided, but for the present I will briefly describe the artistic characteristics of these four regions.



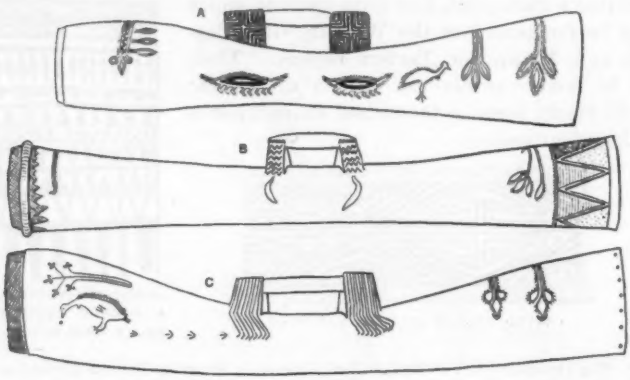
"GEOMETRIC" PATTERNS ON A WOODEN COMB FROM MER, TORRES STRAIT.

CARVED WOODEN BELT, PAPUAN GULF.

* 'The Decorative Art of British New Guinea: a Study in Papuan Ethnography,' *Cunningham Memoir*, x., Royal Irish Academy, Dublin, 1894. *Evolution in Art*, 1895.

Our knowledge of the Western region is confined to objects collected in Torres strait, the coast of Daudai, and the lower Fly river. Most of the decorative objects are bamboo tobacco-pipes, drums, masks, and a

RUBBING OF PART OF THE FOLIAR DECORATION OF A DRUM FROM THE FLY RIVER.



A, B, C, DRUMS FROM DAUDAI, WITH ANIMAL AND PLANT DESIGNS.

few ornaments, combs, etc. These may be ornamented with "geometrical" patterns, but there is not much real variety in the designs, and there is a marked absence of double curves. Even simple curves, such as bowed lines, are not very common; some of these may be regarded as rounded chevrons rather than deliberate crescents. I have recently found that many of the simple "geometric" designs are conventionalized represen-

1 2

1. "GEOMETRIC" PATTERNS BURNT ON A BAMBOO TOBACCO-PIPE FROM THE CENTRAL DISTRICT.
2. PROW OF A CANOE CARVED WITH HEADS OF THE FRIGATE BIRD, MASSIM REGION.

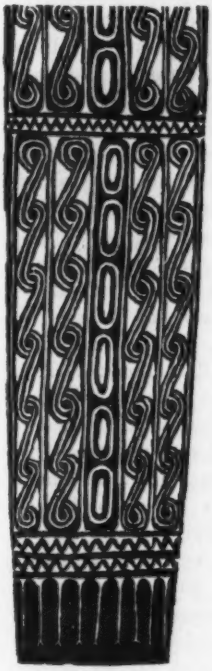
tations of natural forms. Very characteristic of this district is the representation of animals and plants; the former are often cleverly drawn. I discovered the presence of totemism in Torres strait ten years ago, and suspected its occurrence on the mainland of New Guinea. I some time ago put forward the view that the delineation of animal forms was primarily due to the influence of totemism; but I could not account for the plant forms which characterized the art of the Fly river,—I now know

SHIELD AND CEREMONIAL OR MAGICAL TABLETS FROM THE PAPUAN GULF.

CARVED WOODEN BELT FROM THE PAPUAN GULF.

that this is due to the prevalence of plant-totems. Spirals occur in the Fly river, but not in Torres strait.

The decorative art of the Papuan gulf is characterized by the employment of the human face. This degenerates into all sorts of bizarre



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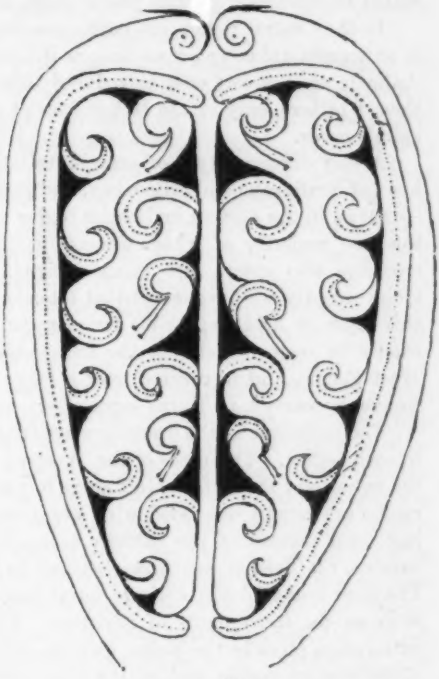

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2

1. FRIGATE-BIRD SCROLLS CARVED ON A CLUB, MASSIM REGION.
2. DANCING SHIELD WITH FRIGATE-BIRD DESIGNS, KIRIWINA.
3. LIME GOURD WITH BURNT DESIGN, KIRIWINA.

patterns. The human form and occasionally animals are pressed into the service. There are few geometric designs that cannot be derived from the human face. Spirals are common. Chalmers * states that the Toaripi "know nothing of carving;" hence most at least of the carved objects stated to come from Toaripi probably originally come from further west.

In the Central region the patterns are "geometric," and their origin is at present unknown; some look as if they might be plant derivatives. Animals are scarcely ever introduced into the decoration of pipes, and then, I believe, only in the Mekeo district; in the same district only do spirals occur.

A very different style of ornamentation is found in the neighbourhood of South cape and Milne bay, and in all the neighbouring islands —that is, in the Eastern or Massim region. Scroll patterns are universal, the vast majority of which are derived from the frigate-bird. The crocodile also enters into many designs, as do other animal forms. Quite recently we have learnt that totemism occurs in this district, and this must be held responsible for many of the zoomorphic designs. It should be remembered that the frigate-bird is the sacred bird of the West Pacific, and is revered over a large area. The human form is frequently carved, in Murua especially. Spirals are very frequent.

The technique of the decorative art is as characteristic as the motive in each region. The pipes of the Western region have etched designs; the patterns of those of the Gulf are in low relief; the pipes of the Central region are usually decorated with burnt-in patterns; but in the Cloudy bay area, instead of the pattern being burnt straight away on the bamboo, the designs are first sketched in outline and then burnt in. The most beautiful and delicate burnt-work of all peoples is to be met with on the lime-gourds of Kiriwina. I have recently found incised patterns on pipes in the Mekeo district, which somewhat resemble those of the western region, and in the Rigo district, which are *sui generis*. The decoration of the shields of the Gulf, Central, and Massim regions is also very distinctive. Indeed, the provenience of any decorated object from British New Guinea can now be located by the motive and technique of the design.

General Conclusions.

On comparing the five cultural maps, certain main features are readily apparent. Taking the distribution of initiation ceremonies, masks, the bull-roarer, and the bow and arrow, we find a continuous distribution from Torres straits, through Daudai and along the whole of the Paupan gulf. The extension of masks into the Mekeo district accords with that of the bow and arrow, which, however, previously extended as far as Redscar bay. The occurrence of communal houses is also characteristic of and peculiar to the gulf, the Fly river, and

* *Journ. Anth. Inst.*, xxvii. p. 332.

Daudai; but they did not extend to Torres strait. On the other hand, south-east of Cape Possession and right as far as Murua and Yela, small family houses alone occur. Canoes with a single outrigger and palm-leaf sails have a similar distribution, except, according to Macgregor, for the absence of sails on the north-east coast or at Kiriwina. Spears, too, have practically the same distribution.

It is thus evident that a division can be made into a western and an eastern group of handicrafts, the dividing-line being somewhere about Freshwater bay. Further evidence for this western and eastern division is afforded by the fact that in the latter tattooing is very widely spread, except in the interior; whereas the marking of the body by means of scars is confined to the Western Papuans. It is only quite recently that a few individuals in the west have adopted a little tattooing owing to intercourse with the Eastern Papuans or with Polynesians. Again, so far as my experience goes, men and women never dance together in the west, but this is the usual practice in the east, at all events among the so-called "Melanesian" tribes. The style of dancing, also, is entirely different in these two divisions.

The maps of the distribution of canoes and decorative art clearly indicate that each group can be further subdivided, and we have (*a*) a western subdivision, in which the canoes have two outriggers and an oblong mat sail, and in which the animals and plants enter into the decorative art; and (*b*) a Gulf subdivision, in which the canoes have neither outrigger nor sail, and in which the patterns are almost invariably derived from the human face. The eastern group is divisible into (*c*) a central subdivision, in which the sails of the canoes have a concave upper margin, and the decoration consists of "geometric" patterns, recognizable animal motives being practically absent; and (*d*) an eastern subdivision, in which the canoes have an elliptical sail, and in which the frigate-bird so permeates the decorative art that scarcely an object can be found which has not some trace in scroll, spiral, or circle of that sacred bird.

The Fly river probably constitutes a subdivision of its own, and the central subdivision is more complicated than these maps indicate. I hope on a future occasion to discuss this problem at greater length, and with additional cultural evidence.

The thirty-one languages or dialects known to Mr. Ray may be grouped thus:

A. Non-Melanesian—

I. *Koiari.* Agi, Ebe, Sogeri, Koitapu, Koiari, Eikiri, Hagari, Maiari, Meroka, Favere, Kupele, Gosisi, Suku.

II. *Neneba.* Neneba, Iworo.

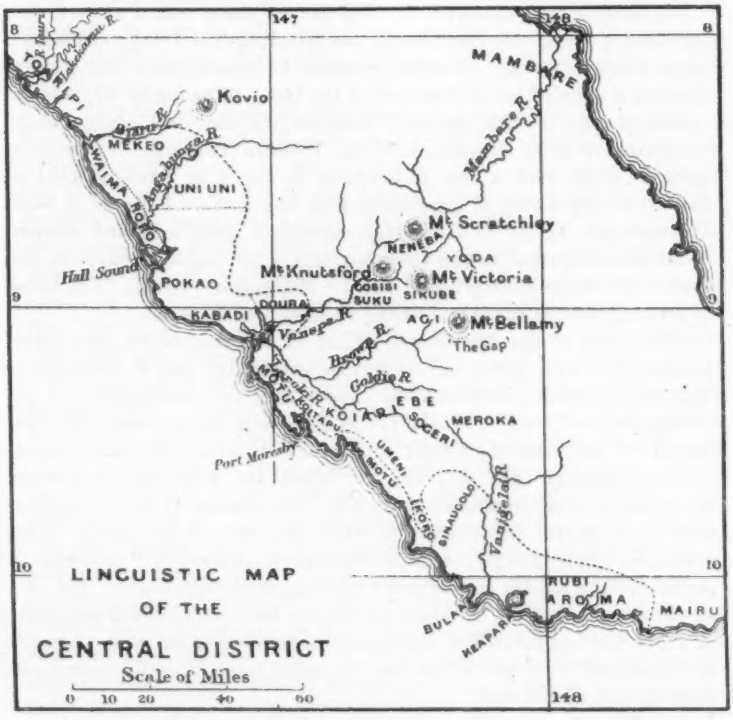
III. *Sikube.* Sikube.

IV. *Mambare.* Mambare, Yoda.

V. *Umeni.* Umeni.

B. Melanesian—

VI. *Mekeo.* Mekeo, Uni Uni.
VII. *Roro.* Roro, Waima.
VIII. *Kabadi.* Kabadi, Pokao.
IX. *Motu.* Motu, Doura.
X. *Sinaugolo.* Sinaugolo, Rubi, Aroma or Keakalo, Keapara, Bulaa (Hula).



Mr. Ray has established the occurrence of two groups of languages in British New Guinea. One of these he terms "Papuan," and the other "Melanesian," as it has close connection with the languages spoken in the great chain of Melanesian islands. Including and west of Toaripi, all the languages are "Papuan," as are also those of the inland people of the peninsula. Of these the following speak "Papuan" dialects: the tribes on the Mambare, Mount Victoria, Mount Knutsford, the Vanapa and Laroki rivers, including the Koiari, Koitapu, Meroka, probably the Umeni and Ikoro, and the Mairu of Cloudy bay and Orangerie bay. So far as Mr. Ray knows, there is no connection between Toaripi, the one or two Koiari groups, and the Mairu, either in grammar or vocabulary. Mr. Holmes states that Toaripi is spoken some distance

inland. The Koiari group of languages shows two fairly distinct divisions; one of these may represent the mountaineers, the other is the true Koiari. No information is yet to hand on the grammatical construction of the mountain languages.

According to Mr. Ray, the Mekeo, Uni Uni, Waima, Roro, Pokao, Kabadi, Doura, Motu, Sinaugolo, Kalo, Bulaa, Keapara, Aroma, and the Rubi (inland to Aroma), speak "Melanesian" dialects. Mekeo is Melanesian in grammar, but altered by some intrusive element. Waima and Roro are the same language—the difference is only in pronunciation; Waima has no trace of the Gulf language. Pokao may belong to the Motu group. Doura and Motu are the same. Sinaugolo is the principal language of the remaining group. Rubi and Keakalo are almost identical with it. Keapara and Bulaa differ only in the pronunciation of some words; the structure of all these dialects is identical. The grammars of the Mekeo, Waima, Roro group are very much alike, but are distinct from the Pokao, Kabadi, Motu, Sinaugolo, etc., group. Mr. Ray has kindly permitted me to make use of the foregoing unpublished material.

Mr. Ray had previously stated that the "Melanesian" dialects of Milne bay district and of the archipelago beyond are of a somewhat different character from the former group. In fact, he goes so far as to say "the language of Suau (South cape) appears very similar to those of San Cristoval, in the Solomon islands, which lies almost due east of South cape. The Motu and Kerepunu (Keapara) agree more with the languages of the Efate district, in the Central New Hebrides."*

It is not possible at present to fit in all these facts with our existing knowledge of the head-form of the natives of British New Guinea.

The dolichocephals may certainly be regarded as an autocthonous people; physical anthropology, ethnography, and linguistics are fairly well in accord on this point.

The eastern insular, or Massim, brachycephals present little difficulty; they may safely be regarded as an immigrant people that came from the Melanesian archipelago and saddled themselves on a pre-existing dolichocephalic population.

I confess to experiencing a great difficulty in deciding about the brachycephals of the central district. Provisionally, I would suggest that we have here to deal with a dual element: (1) An inland group which is gradually forcing its way to the coast; there is at present no reason to believe that this is not an indigenous group. (2) The Motu stock, which apparently is an immigrant people.

There is also the problem of the origin of the western brachycephals. These I regard as a branch of the autocthonous brachycephals, whose presence has now been proved by me in the central district.

* *Journ. Anthrop. Inst.*, xxiv., 1894, p. 32.

Future research may perhaps determine whether the brachycephals have all along existed side by side with the dolichocephals in New Guinea, or whether they have immigrated into New Guinea at various times. If the latter prove to be the case, then we have in British New Guinea at least three distinct migrations, the oldest being that of the western and central brachycephals, the Motu and the Massim brachycephals representing later but entirely separate waves.

After the reading of the paper, the following discussion took place:—

Mr. SELIGMANN: I am sure we must all have been very much delighted with the paper, but I don't think any one, with the exception of Mr. Ray, was quite as delighted as I was. We were with Prof. Haddon on this expedition. He said something about the extreme sweetness of the native. Well, he was something of a demigod to them, certainly rather more than a father. At Murray island they said, "He close up alongside God. He savvy too much."

There are one or two points I might mention this evening. In the maps of New Guinea one or two things came out very markedly; for instance, the Mekeo district, where there are large fertile plains of recent alluvial soil, is the place where the best yams grow. That district is the chief, if not the only, one on the south-eastern coast of New Guinea where we have a large amount of leprosy; it is endemic. The interest of that is that recently a book has been published, a prize essay on leprosy, by Dr. Ashburton Thompson of Sydney, in which he treats the history of leprosy carefully, and shows that it is almost certain that leprosy, in Australia, was introduced by Asiatics, perhaps Chinese. There is no record of it before they came. Well, in this fertile valley in New Guinea we have it, not only in the coast villages—possibly there it has some connection with the mangrove swamps—but right up inland. I have seen cases in villages 18 to 20 miles up the river, where it is absolutely certain there is no trace of Asiatic contamination. Then, again, the system of charms and magic varies immensely. In Port Moresby, and extending down the coast as far as the Rigo district, stones play a large part in the system of charms. You find a black stone which has a more or less superficial resemblance to a yam in shape. This, the native says, is a charm for yams. It is used as follows: You pour a little water over it, and then let the water fall on the seed-yams; that will always give you a good crop. If you find a stone with a slight constriction in the middle, like an egg-glass with a broad waist, that form of yam-stone has only to be kept in the house, then there will be plenty of yams. I have known the stopper of a Worcester-sauce bottle left on the side of a hill, where the rain-water could sweep over it before coming down on the fields to wet the roots of the bananas and yams. In the Mekeo district there is no trace of that. The people are agricultural, but they have absolutely nothing corresponding to the yam-stone. The same thing is found in regard to the fishing magic; it is totally different in the different districts, and I think the same may be said as regards their medicine charms and sorcery charms. In New Guinea there is an extraordinary percentage of albinos, and there is nothing more odd than to see a frizzly headed native of a pinkish white colour; his eyes, however, are not pink like those of European albinos or white rats, but are of a grey colour.

Mr. RAY: At this late hour I do not propose to make many remarks. I had the pleasure of seeing in the flesh what you have seen in the shadow. My own special province was linguistics, and the languages generally bear out the evidence Prof. Haddon has got together to illustrate the distribution of culture. In the western part of New Guinea, and in the interior districts, the type of language

is very different to that on the coast and in the south. In the south-east the languages are very closely allied to those of Fiji and the Solomon islands and the New Hebrides, while the languages of the west and central districts are entirely different. No specimens of the grammar of the languages save those I was able to obtain have yet been gathered, but, generally speaking, they bear out the conclusions derived from the study of the other features of the people.

The PRESIDENT: The interest of this paper to us, and our science, is that it shows how the geographical features and physical aspects of a country react upon the industries and arts, customs and character, of its inhabitants. Prof. Haddon, in his excellent address, has shown and explained that to us very fully, and he has done so with the aid of the most beautiful and interesting series of illustrations by photographs we have almost ever seen in this hall. I am sure that you will all wish to pass a very cordial vote of thanks to Prof. Haddon for his address.

GEOGRAPHY AT THE BRITISH ASSOCIATION, BRADFORD, 1900.

THE Bradford meeting of the British Association for the Advancement of Science proved to be one of the most successful of recent years. The hospitality of the citizens of Bradford, both in their corporate and in their individual capacities, was almost unbounded, and the weather continued with scarcely an exception bright and cool. The Geographical Section was most commodiously housed in the Church Institute, and the descriptive papers drew as large audiences as ever. The more scientific papers, however, were sometimes read to a nearly empty hall. Much assistance was rendered to the work of the section by the diligence and enthusiasm of Mr. Wethey, the local sectional secretary. The complete list of sectional officers was as follows—the names of persons unqualified by presence at the meeting or membership of the Association being omitted :—

President: Sir George S. Robertson, K.C.S.I. *Vice-Presidents:* Sir Thomas H. Holdich, K.C.I.E.; Dr. H. R. Mill; Dr. J. Scott Keltie; E. G. Ravenstein. *Secretaries:* H. N. Dickson, B.SC. (Recorder); Edward Heawood, M.A.; E. R. Wethey, M.A.; *Committee:* Lieut.-Colonel F. Bailey; J. Bolton; G. G. Chisholm; Vaughan Cornish; H. T. Crook; Dr. H. O. Forbes; R. A. Gregory; Colonel D. A. Johnston; J. E. Marr, F.R.S.; Staff-Com. Dubois Phillips; T. G. Rooper; Eli Sowerbutts.

The section met on four days, and, in addition to the presidential address, twenty papers or reports were brought before it. Sir William Turner, President of the Association, was present when the presidential address of Section E was read, and at its close he moved a vote of thanks to Sir George Robertson in terms of high appreciation. The full text of the address is published in this *Journal*, p. 447.

On Thursday, September 6, the afternoon was occupied by two papers on educational subjects and an interesting discussion upon them. Mr.

T. G. Rooper, one of her Majesty's Inspectors of Schools formerly in the Bradford district, dealt with the "Progress of Geographical Instruction in Elementary Schools," especially in the West Riding. He said that the West Riding of Yorkshire held the foremost place in the movement for reform in methods of teaching which was begun through the Royal Geographical Society. The first impulse came from the Yorkshire College, and then active steps were taken in Leeds, Bradford, and Sheffield, and the movement was much stimulated by the exhibition of the Royal Geographical Society's collection of foreign maps in Bradford in the year 1887. The conferences following this exhibition discovered the chief defects in the existing instruction: (1) lessons in geography were not based on object teaching, nor on the observation of local features and scenery; (2) the art of "reading" maps was not taught, nor was the construction of a map led up to by making plans of short walks and diagrams of the neighbourhood; (3) the study of political and commercial geography was not based upon the study of physical geography, neither were the details of geographical study connected as cause and effect. There was no attempt to present a country to the scholar as a connected whole, and the lessons consisted of lists of names and figures, at the best arranged in groups. Of such details many were wholly unsuited to the elementary stage. The chief reforms consisted in the intelligent study of local geography through local maps and models, and in object lessons which explained the principles of physical geography. The reliefs and models led up to the art of reading maps and to the demand for better maps. Such lessons were an excellent introduction to reasoning, and proved how little there was that was purely arbitrary even in the sites of towns and villages in the neighbourhood, much less in the industries which were carried on in them. The necessity for good wall-maps was now apparent, and correctly drawn details were demanded in place of vague and inaccurate sketches. The symbols on the wall-map were vague and meaningless unless a context and significance were given them by previous practice in the building up of local plans and maps. The scholar had to be taught with care how to translate the symbols of the wall-map back into the forms of nature which they, however inadequately, represented. The value of graphic work in teaching geography was insisted on. The mere copying and colouring maps of various parts of the world was rather an exercise in drawing than in geography. Each map should be drawn to serve some definite purpose. It should disentangle from a complex whole some particular part which analysis brought to light, and illustrate it with precision and simplicity. Further, the sketch-maps should proceed from simpler studies to more complex, and no map should be made of a country as a whole until the leading features had been dealt with separately, and thus the "constructive" method of teaching geography was introduced.

In conclusion the formation of local geographical societies for educational purposes was recommended, and an account was given of the formation and working of the Southampton Geographical Society.

Mr. E. R. Wethey described the methods he employed in the teaching of commercial geography, and exhibited a large number of exceedingly effective lantern slides of his own construction, which he had devised to enforce the points of his lectures. Both papers were discussed together, Dr. H. R. Mill, Mr. S. P. Unwin, Mr. C. T. Whitmell, and Dr. Scott Keltie uniting in expressing admiration of the work done in promoting geographical education by Mr. Rooper and Mr. Wethey. A number of boldly executed reliefs of typical geographical features and of local configuration made by Yorkshire schoolmasters was shown at the meeting.

On Friday, September 7, Dr. H. R. Mill read a paper on the "Treatment of Regional Geography," with regard to which the opinion was expressed by several speakers that the most convenient unit for such descriptions was the county rather than the map-sheet, and that local scientific societies should be encouraged to take up such work.

Mr. E. G. Ravenstein read a paper on "Foreign and Colonial Surveys," which will be published in a subsequent number of the *Journal*, and a communication from Mr. B. V. Darbishire on "Military Maps" was brought before the meeting by the recorder, in the unavoidable absence of the author. Captain H. H. P. Deasy had a crowded audience when he described, in the afternoon, the incidents of his great journeys in Central Asia, particulars of which appear in the *Journal* for August, p. 141. Prof. J. Milne read a paper on "Large Earthquakes recorded in 1899." He said that in 1899 at Shide, in the Isle of Wight, 130 earthquakes were recorded. The greater number of these were also observed at Kew, whilst very many of them were common to registers from Canada, the Cape of Good Hope, India, Java, Japan, and other distant countries. Analysis of these records has increased our knowledge respecting the rates at which motion is transmitted through the Earth, and indirectly thrown new light upon its rigidity. The velocity of surface waves has been investigated, and new rules based on these investigations have been formulated for determining the position of earthquake origins. It has, for example, been shown that the distance of an origin from a given station can be determined either from the interval by which the preliminary tremors outrace the larger surface waves, or from the interval between the arrivals of waves which had travelled from their origin round the world in opposite directions. One series of observations showed that the amplitude of the large waves of earthquakes decreased more rapidly when traversing suboceanic paths than when they radiated over continental surfaces. In discussing the nature of large waves this observation on the damping effect of oceans was used as an argument that this form of seismic movement represented

gravitational surface waves rather than the outcrop of distortional waves propagated through the body of the Earth. One hundred and twenty-five out of the 130 records considered represented disturbances which had suboceanic origins, and if we except one group we see that the Pacific origins are on the face or at the bottom of "deeps," which form portions of the trough or troughs around the eastern and western margins of that ocean. If future soundings show that the indicated exception is only apparent, then the second group will also illustrate the rule that accelerations in secular adjustments of the Earth's crust are most frequent where this exhibits the greatest flexure. As there are reasons for believing that each of these earthquakes was accompanied by large mechanical displacements of solid materials, the importance of localizing the sites where such changes are frequent is evident to those who select routes for deep-sea cables.

The Report of the committee on the climate of tropical Africa was presented, and the committee asked to be reappointed, in order that its work might complete the record of ten years' observations.

On Monday, September 10, Sir Thomas Holdich opened the proceedings by an important paper on "Railway Connection with India," which he considered under the following heads :—

"1. The impracticability of the northern approaches to India leading over the Hindu Kush into Kashmir or Afghanistan from the Oxus regions.

"2. The nature of the great transverse water-divide of Asia, which includes the Hindu Kush, and the most favourable points for crossing it.

"3. The opening afforded by the Hari Rud river to the west of Herat.

"4. The configuration of the Persian plateau and mountains, and its adaptation to railway alignment.

"5. Consideration of Persian lines of communication with Western India. The coast-line between Basra, at the head of the Persian gulf, and Karachi. Details of alignment. Commercial and climatic objections to such a line as far as Bandar Abbas.

"6. Alternative central line from Western Persia to Bandar Abbas. Difficulties of connection with European systems.

"7. Details of alignment between Bandar Abbas and Karachi. Difficulties of coast line, and possibility of interior central line.

"8. The proposed connection between Kushk and Chaman (*i.e.* the Herat-Kandahar line). Geographical conditions that exist between Kushk and Herat, and between Herat and Kandahar. Their favourable nature.

"9. Objections which have been raised to the line—political and military. Its commercial prospects."

Mr. C. Raymond Beazley described a recent trip eastward on the Siberian railway, and gave some historical data as to the development of Russian Asia, and Mr. R. T. Günther showed the importance of the

detailed study of submerged buildings in the neighbourhood of the Phlegræan fields, in order to arrive at some definite conclusions as to the date of the great changes of level.

Mr. C. E. Borchgrevink attracted a crowded house to hear his description of the British Antarctic Expedition of 1899–1900, under his command, and Mr. C. J. Cutliffe Hyne contributed some notes of a holiday trip through Lapland.

The proceedings of the day terminated with the Report of a committee on the revision of the physical and chemical constants of sea-water. This committee was appointed to co-operate in the investigations undertaken by Dr. Martin Knudsen at Copenhagen, at the instance of the committee appointed by the International Conference held at Stockholm last year, with the view of making authoritative determinations of the constants used in reducing observations of the physical and chemical conditions of sea-water in different parts of the globe.

Dr. Knudsen reports that the work of obtaining samples of water from different regions has been completed, except with regard to those from the East Greenland polar current, the northern part of the Baltic, and the Indian ocean, which it is hoped will be received in about a month's time. The samples have been collected in 6-litre bottles, prepared by standing full of hot water for a month before use. Dr. Knudsen and his assistants began preliminary work in September last, and since May the regular analyses of samples have been carried on by himself, two chemists, and three physicists. The results obtained so far indicate that the methods employed are adequate in scope and precision, and sufficient progress has been made to justify the expectation that the work will be completed and published within the time arranged by the Stockholm committee.

On Tuesday, September 11, a paper was read by Mr. G. G. Chisholm on "Some consequences that may be anticipated from Development of the Resources of China by modern methods." He pointed out that the peculiarity of the position of China is this, that it is the one region in the world with all the means for industrial development on a gigantic scale that remains to be opened up. In the past thirty or forty years we have chiefly seen the opening up of new countries or old countries without great resources for industrial development.

Among the consequences that may be anticipated from the opening up of China, he noted—

"1. A rise in prices in China, especially in the industrial regions.

"2. The creation of a demand for food-stuffs not likely to be supplied by China itself: a demand which, in itself, will be one of the most powerful causes contributing to maintain the rise in prices.

"3. The imparting of a great stimulus to the food-producing regions most favourably situated for meeting this demand, more particularly

Manchuria, Siberia, and western North America, probably the Pacific States of North America to a greater extent than Canada.

"4. Perhaps the most important of all, the creation of a tendency to a gradual but prolonged rise in wheat and other grain prices all the world over, reversing the process that has been going on since about 1870 in consequence of the successive opening up of new countries."

Mr. E. Heawood read a paper on the "Commercial Resources of Tropical Africa," in which he examined the causes of the present small commercial movement of that region; and, by a comparison with Brazil and other tropical countries, arrived at the conclusion that the future of Tropical Africa depends on the development of its agricultural products.

Mr. Vaughan Cornish read a paper on "Snow-ripples and Sastrugi," illustrated by a number of interesting photographs taken last winter in Scotland. This paper is preliminary to a fuller study of the wave-forms of snow surfaces to be carried out in colder regions.

Mr. E. G. Ravenstein brought forward an account of his researches on the geographical distribution of relative humidity, illustrated by a series of new maps. It is hoped that the complete paper may ultimately appear in this *Journal*.

Mr. J. E. Marr read a short but important paper on the peculiar form of isolated hill known from its popular Welsh name as a Moel. This paper will be published in a subsequent number of the *Journal*.

The last paper submitted to the section was an account of the "Pettersson-Nansen Insulating Water-bottle," by Dr. H. R. Mill, who also exhibited the apparatus in action at the museum which was provided in connection with the sections. An illustrated description of the water-bottle will be published in these pages.

Many important papers bearing closely on geography were read in other sections. In Section A, the subsection of Meteorology, which met on Monday, had to consider a very important paper by Captain Campbell Hepworth, on the "Weather of the North Atlantic Ocean in the Winter of 1898–99." The weather of the period was of an unusually tempestuous character, and the stormy seas were associated with abnormal warmth over Europe, and equally abnormal cold over North America.

The age of the Earth was considered by Prof. J. Joly in Section C, his estimates being based on the amount of sodium salts in solution in the sea. Mr. Harmer read a suggestive paper to the same section on the light which may be thrown on the climate of interglacial and glacial periods by considering the effect of the distribution of atmospheric pressure which may be deduced from the probable arrangement of land and sea at the periods in question.

Mr. R. D. Oldham pointed out in a short paper that already the new coast-line of Thirlmere, formed by raising the level of the lake in 1895,

is beginning to assume the usual outlines of a mature lake-shore in consequence of wave-action.

Finally we must notice the action taken by all the sections in submitting to the Council of the Association for its consideration a proposal to create a new section to deal with questions directly regarding education.

POLITICAL GEOGRAPHY AND THE EMPIRE.*

By Sir GEORGE S. ROBERTSON, K.C.S.I.

When the British Association for the Advancement of Science honoured me with an invitation to preside over this Section, I accepted the distinction, thoughtfully and with sincere gratification. The selection as your President at Bradford, this great and interesting centre of commercial energy, of a student of political movements who was also deeply interested in the science of geography, seemed to point suggestively to a particular branch of our subject as appropriate for an opening address. This consideration, and, to my thinking, the fitness of the occasion, led me to believe that the British Empire itself was a very proper subject for such reflections as could be compressed within the limits of an inaugural Presidential Address. Many of my predecessors have eloquently and wisely dealt with various topics of admitted geographical rectitude—with geography in its more strictly scientific study, with its nature and its purview, with its recent progress, and with the all-important question of how it could be best taught methodically, and how most profitably it might be studied. In dealing with the important practical application of our science to the facts of national life—political geography—I feel that perhaps a word of explanation is necessary. Pure geography, with its placid aloofness and its far-stretching outlook, combined sometimes with a too rigid devotion to the facts and conclusions of strict geographical research, is apt to incline many scientific minds to an admirable quiet-eyed cosmopolitanism—the cosmopolitanism of the cloistered college or the lecture theatre. It perhaps also at times has a tendency to create in purely academic students a feeling of half disdain or of amicable irritability against those who love the science for its political and social suggestiveness and elucidations. Thus there is a possible danger that geographers of high intellectual calibre, with enthusiasms entirely scholarly, may come to underrate nationality and to look upon the world and mankind as the units, and upon people and confederacies and amalgamations merely as specific instances of the general type. We know that geography is often looked upon as the science of foreign countries more especially. Such mental confusion is undoubtedly less common than it was, yet it still influences, unconsciously, the minds of many people. It is well not to forget this curious fact, and to point out, as if it required emphasizing, that there is nothing foreign to geographical thought in the association of geography and patriotism, and that the home country is worthy of careful study, particularly when, as with us, our home country is not Yorkshire, nor England, nor the United Kingdom, but the whole British Empire. That is my justification and my apology for taking political geography and the British Empire as my subject, if justification and apology seem to any one to be necessary. To the generous hearts of our distinguished foreign visitors, who honour

* Presidential Address to the Geographical Section, British Association, Bradford, 1900.

us quite as much as they delight us by their presence, I am sure of my appeal. Every true man loves his own country the best in the world. That beautifying love of country does not require him to be ignorant of or to hate other countries. The community of the civilized nations, no longer to be described as Christendom even, for Japan has been received into it, is a mighty fact in geography no less than in politics. To love mankind one must begin by loving individuals; before attaining to true cosmopolitanism one must first be patriotic.

Now, besides dealing with the topography of the globe, geography considers also the collective distribution of all animal, vegetable, and mineral productions which are found upon its surface. The aspect of the science which deals with man's environment, and with those influences which mould his national character and compel his social as well as his political organization, is profoundly interesting intrinsically and of enormous practical usefulness when rightly applied. Given the minute topography of a country, a complete description of its surface features, its rivers, mountains, plains, and boundaries, a full account of its vegetable and mineral resources, a knowledge of its climatic variations, we have at once disclosed to us the scene where we may study with something like clearness man's procession through the ages. Many of the secrets of human action in the past are explained by the land-forms of the globe, while existing social conditions and social organizations can often thereby be intelligently examined and understood. Persistent national characteristics are often easy to explain from such considerations. For instance, the doggedness of the Dutch river-population, caused very greatly by a perpetual struggle against the sea, or the commercial carrier-instinct of the Norwegians, those northern folk born in a country which is all sea-coast of countless indentations. Having few products to barter, the Norwegians hire themselves to transport the merchandise of other peoples. We British also were obviously predestined to isolation and insularity, when perhaps in the human period the Thames ceased to be a tributary of the Rhine. Our Irish fellow-countrymen were similarly fated for all time to lead a separate, special, and national life apart from our own, when at a still earlier period, geologically, the Irish channel was formed.

Such large-scale facts are not to be overlooked; there are others, however, of varying degrees of prominence. Some merely require to be interpreted thoughtfully, while others, after diligent study, may still remain dubious and matter for speculation. Geography is the true basis of historical investigation and the elucidation of contemporary movements. At the present time great social and political changes are occurring throughout the world—in Europe, Asia, Africa, and America, and in the islands of the great seas. These changes are absolutely dependent upon the physical peculiarities of the different lands acting upon generations of men during a prolonged period of time. As a consequence of certain soils, geographical characteristics, and climates, we notice how harsh surroundings have disciplined some races to hardiness and strenuous industry, accompanied by keen commercial activity, which is itself both a result of increasing population and the cause of still greater overcrowding. Then we see other people at first sight more happily circumstanced. With them the struggle to live is less ferocious; their food is found with little toil. But we perceive that the outcome of generations of Nature's favouritism has been to leave them less forceful and less ingenious in the never-ending warfare of existence. By comparison they grow feeble of defence against the hungrier nations, ravenous for provender. Man for ever preys upon his own kind, and an easy life in bland surroundings induces a flabbiness which is powerless against the iron training of harsh latitudes, or against the fierce energy and the virile strength produced by hereditary wrestling with unkindly ground.

The discovery of America and Vasco da Gama's voyage round the Cape originated movements and brought into play those subtle influences of foreign lands upon alien sojourners, and through them upon their distant kindred, which alter the course of history and modify national manners and perhaps national characteristics also. The colonization of territories in the temperate zone by European Governments, separated by vast ocean-spaces from their offshoots, has given origin to new and distinct nations different from the parent stock in modes of thought and in ways of life, a result due mainly, no doubt, to local physical conditions, but in part also, if only in part, to detachment, to complete and actual severance from the mother country. This brings us to that most interesting and important topic, geographically speaking, of Distance, an aspect of our science which is of the utmost concern to traders and to statesmen; indeed, an eminent German geographer defines geography as the Science of Distances. To this subject of Distance I wish in particular to direct your attention, and especially to its bearings upon the British Empire.

The British Empire is equal in size to four Europes, while its population approximates four hundred millions. Although that may seem a somewhat grandiloquent method of description, it is a fairly accurate statement of fact. Still more interesting to us is another truth—that outside of these islands we have some ten millions of white-skinned English-speaking fellow-subjects. These islands are scarcely more than one-hundredth part of the whole Empire, although we count as four-fifths of its white population; of the total number of the Queen's subjects we are, however, no more than a tenth.

"British Empire" is somewhat of a misnomer, just as the North American and Australian Colonies were never colonies at all in the classical sense of the word. For the colonies are not independent of the mother country. An empire, again, really means a number of subject peoples brought together, and at first held together, by force. India is an empire, for instance. Some new title or phrase would have to be invented to describe accurately all the possessions of the British Crown from the Government of India through all possible grades of more or less direct control until we come to some colony with representative institutions, and thence to the great commonwealths with responsible legislators and responsible cabinets. Happily, however, there is no need now for any novel designation. The style "British Empire" has become in time of stress a rallying cry for all the Queen's subjects, and the term has been sanctified by the noble eager devotion shown to her Majesty, both as a beloved and venerated constitutional sovereign, and as the common bond of unity between those great self-governing daughter-nations which we in the past were accustomed to speak of as "our colonies." Consequently "British Empire" has henceforward a clearly defined, a distinct, a national significance, just as Imperialism has a special and peculiar meaning to all of us. We understand by "British Empire" and by "British Imperialism" a confederacy of many lands under the rule of her Britannic Majesty. This confederacy is dominated by white peoples—Anglo-Saxons, Celts, French-Canadians, and others—knit together in most instances by the ties of blood relationship, but with equal if not greater closeness by common interests, an identical civilization, and a love of liberty, in addition to that dignified but enthusiastic acceptance already referred to, of the constitutional sovereignty of the same Queen. We may hope that generous democratic expansiveness and social assimilation will also in time detain willingly within the limits of this British confederacy of white peoples those other Christians and distant kinsfolk of ours in South Africa who are at present so bitterly antagonistic.

Ruled and controlled under liberal ideals by the centre of authority, there are,

in addition, the great subject territories whose non-Christian population are less advanced in moral and material progress. They exhibit, indeed, every degree of backwardness, from the barbarism of the savagest tribesman to the intellectual but archaic civilization of ancient Asiatic nationalities.

Concerning the British Empire, and comparing it with other empires, ancient, recent, or now existing, its two most remarkable features are its prodigious and long-continued growth and the persistency of its power. It cannot to all seeming grow much larger, from lack of expansive possibility. But it is unprofitable to predict. Every step which has been taken in the way of extension, particularly of late years, has been against the wishes and in almost passionate opposition to the views of large sections of the people. Yet the process of enlargement has gone on continually, being often in actual despite of a Government, whose members find themselves powerless to prevent absorptions and concretions which they would gladly avoid. Objections to this perpetual growth of empire in territory, and to the resulting responsibility which we not altogether willingly accept, are unanswerable theoretically. The too heavy and continually increasing strain upon our military resources every one can appreciate. The limit in power of the strongest navy in the world is at least as obvious as the vital necessity that our Navy be largely and ungrudgingly strengthened. Naturally the cry of cautious patriotic men is the same now that it has always been—"Consolidate before you step farther." In India, owing to conscientious and strenuous opposition to every suggestion of expansion and to the almost violent form which that opposition often took, our progress has been on the whole slow and comparatively safe. We have (I, of course, avoid all allusion to very recent policy) as a rule consolidated, strengthened ourselves, and made our ground sure before another advance. But there is a general impression that in other parts of the world we have been hastily and unfortunately acquisitive, whether we could help it or not; that the new provinces, districts, and protectorates are some of them weak to fluidity; that the great and unprecedented growth of the Empire has led to a stretching and thinning of its holding links, which are overstrained by the weight of unwieldy extension and far beyond the help of a protecting hand. I hope to be able to show that in some important respects this suspicion is not altogether true; that science, human ingenuity, and racial energy have given us some compensations; and that it is not paradoxical nor incorrect to say that our recent enormous growth of empire has been everywhere accompanied by a remarkable shrinkage of distances—by quicker and closer intercommunication of all its parts one with another and with the heart centre. In short, the British Empire, in spite of its seemingly reckless outspread, its sometimes cloudy boundaries, its almost vague and apparently meaningless growth, is at the present day more braced together, more manageable, and more vigorous as a complete organization than it was sixty years ago. The difference between its actual extent in the last year of the century and its size at the date of the Queen's accession can be estimated by a glance at a remarkable series of maps published in the 'Statesman's Year-book for 1897,' while since 1897, and at this instant as we all know well, its mighty bulk is being still further increased.

The world as a whole has strangely contracted owing to a bewildering increase in lines of communication, to our more detailed geographical knowledge, to the formation of new harbours, the extension of railways, the increased speed and the increased number of steamships, and the greatly augmented carrying power of great sailing vessels built of steel. Then, hardly second in importance to these influences are the great land lines and the sea-cables, the postal improvements, the telephones, and, perhaps we may soon add, the proved commercial utility of

wireless telegraphy. This universal time-diminution in verbal and personal contact has brought the colonies, our dependencies, protectorates, and our dependencies of dependencies, closer to each other and all of them nearer still to us. Measured by *time-distance*, which is the controller of the merchant and the cabinet minister just as much as of the soldier, the world has indeed wonderfully contracted, and with this lessening the dominions of the Queen have been rapidly consolidating. Nor is this powerful influence by any means exhausted. In the near future we may anticipate equally remarkable improvements of a like kind, especially in railways, telegraph lines and deep-sea cables, and in other scientific discoveries for transmitting man's messages through water, in the air, or perhaps by the vibrations of the earth. For us particularly, railway schemes of expansion must be mainly relied upon to open up and to connect distant parts of the Empire. Our true and only trustworthy road of intercommunication between the heart of the Empire and its limits must always be the sea. For general trade purposes, such as the convenience of business travellers, all continental lines and all the great projected railways will be helpful, whatever nation controls them; but our certain security is the sea, the sea which protects us, which has taught us to be an Imperial people. If we ever forget that, there may be a calamitous awakening. We must not be persuaded to build—or at any rate to place reliance upon—land roads or railways through regions inhabited by tribes and peoples over whom we have not complete military as well as political control. Persian, Arabian, North African railway projects are happily rarely heard of now. As national enterprises they never were and never could be practicable, or otherwise than dangerous mistakes. We are a world-power solely because of our worship and because of our command of the sea. In the future also we shall remain a world-power only so long as we hold command of the sea in the fullest sense of the term, not merely by the force and efficiency of the fighting Navy, but by the excellence and the perfecting of our mercantile marine, by increasing its magnitude, carrying power, and speed, and by anxiously attending to its recruitment by British sailors. We must not attempt to overtax our resources to guard railway lines through foreign semi-civilized or savage countries by exported or local armies. A heavy land responsibility lies upon us already. Under a little more we might be easily overweighted and crushed down. We must concentrate all our surplus energies upon our sea communications. Therefore the railway lines which I spoke of as helping to consolidate the Empire in the near future are those only which are projected or are being built in the various colonies and dependencies, lines to distribute and collect, to connect provinces, and feed harbours. The mighty Canadian Pacific Railway is unique in the Empire. It not only complies with all these requirements, but in addition it provides to Australia and the Eastern dependencies an alternative road, convenient and safe. As I said before, all railways, wherever built, will probably help us directly or indirectly in the long run, provided we are never committed to the protection of any one of them outside of our own boundaries.

And what has been said about railways applies, with obvious modifications, to telegraph lines and to maritime cables. The more general the extension of these, and the more numerous they become, the greater benefit will there be to this country in its double capacity as the greatest trader and the greatest carrier of merchandise in the world; while the actual equivalent to a diminution of time-distance in travelling is to be found in the instantaneous verbal message which can be despatched to the most distant point of the Empire. But we ought certainly to join all the shores of the Queen's dominions by sea-cables completely controlled by British authority. To rely upon connection between our own cables through

telegraph systems stretching across foreign countries, however friendly, or to permit the ends of these sentient nerves of the Empire to emerge upon shores which might possibly become an enemy's country, is dangerous to the point of recklessness, that parent of disaster. As a melancholy instance of my meaning, it is only necessary for us to remember the Pekin catastrophe—how we suffered from those dreadful intervals of dead silence, when we could not even communicate directly with our own naval officers at Taku, or with any one beyond Shanghai, although we have in our possession a place of arms at Wei-hai-Wei, upon the Gulf of Pechili. It is obvious that we ought to have an all-British cable for pure strategic reasons as far as Wei-hai-Wei, our permanent military outpost on the mainland.

To give some suggestion of the increased facilities for carrying merchandise, for conveying passengers quickly about the world, and for the sending of messages to all parts of the Earth, a few, a very few, salient facts may be quoted about ships—sailing-ships and steam-vessels—and about telegraphs and cables.

In 1870 there were no more than ten British sailing-ships which exceeded or reached two thousand tons burden. In 1892 the yards on the Clyde alone launched forty-six steel sailing-ships which averaged two thousand tons each. In 1895 the number of large steel sailing-ships being built in the United Kingdom was down to twenty-three, and, speaking generally, it is inevitable that sailing-vessels must give way to ocean steamships for most kinds of cargo—cattle, coals, wool, grain, oil, and everything else.

Now let us turn to the results in shortening journeys accomplished by the progress made in the construction and in the driving machinery of steamships within the last forty years, which has especially been fruitful in such improvements.

During this century the six months' voyage round the Cape to India became a forty and then a thirty days' journey by what was known as the overland route for mails and passengers through Egypt. By degrees it had become shorter still by the railway extensions on the Continent, and by the unbroken steamship passage through the Suez canal, until now the mails and hurrying travellers may reach London in twelve or fourteen days after leaving Bombay; and the great liners of the P. & O. Company can arrive in the Thames eight days later. This famous corporation, after her Majesty had been reigning nearly ten years, possessed only fourteen ships, with an aggregate of 14,600 tons. Now it owns a princely fleet of fifty-three ocean steamers, with a total capacity of 142,320 tons. Practically the voyage to India in her Majesty's reign had been diminished by one-half at least.

Since the Queen's accession the passage between the British Isles and the Commonwealth of Australia has grown shorter, from the ninety days taken by the sailing-clippers to the fifty-three days occupied by Brunel's *Great Britain*. At the present time it lasts from thirty to thirty-five days by the Suez canal route, while it has been finished in as little as twenty-eight days. Australia is consequently only half as far away, in time, as it was; while, if the Suez canal were closed for any reason, we have at our disposal, in addition to the Cape route with its quick steamers, which is linked to us by the Pacific ocean road, the splendid service of that empire-consolidator, the Canadian Pacific Railway.

The important part played by the Suez canal in this connection will be discussed a little later. Now I am merely indicating by a few well-known facts the diminution of distance by the improvements which have been made in the ships themselves and in their propelling machines.

Across the Atlantic the rapidity of travelling and the general average speed of

all cargo steamers have increased remarkably. Very interesting statistics on this point were given to the British Association for the advancement of science last year, at Dover, by Sir William White, in the Presidential Address of Section G. We may say, without repeating details, that during the last half of the nineteenth century the breadth of the Atlantic has practically been diminished one-half.

In 1857 the Union Company contracted to carry mails in thirty-seven days to the Cape. Now the contract time is nineteen days. This again diminishes the distance by one-half. As an instance of the remarkable change which has been made in steamships within forty years, it may be mentioned that the first *Norman* of the Union Company took forty-two days to reach the Cape, while the present *Norman* has covered the journey in fourteen days twenty-one hours. I need not specify particularly the equivalent acceleration of speed upon other great steamship lines. All our sea distances have been shortened fifty to sixty per cent. in an identical way.

It is not too bold to predict that the Atlantic, from Queenstown to New York, will, before long, be steamed in less than four days. The question has resolved itself simply into this—will it pay shipowners to burn so much coal as to ensure these rushing journeys before a cheaper substitute for coal is found? We know that a torpedo-destroyer has been driven through the water at the rate of forty-three miles an hour by the use of the turbo-motor instead of reciprocating engines. Consequently an enormous increase in the present speed of the great Atlantic liners is certain if the new system can be applied to large vessels. By such very swift steamers, and by the example they will set to all established and competing steamship companies, the journey to Canada, and subsequently to all other parts of the Empire, will be continually quickened, until predictions which would now sound extravagant will in a few years be simple everyday facts.

We must turn next to the subject of telegraphic communication, especially as it relates to the British Empire.

The mazes of land-lines, and of sea and ocean cables, are too numerous and intricate to be described in detail. Also the general effect of this means of bringing distant peoples together, and its transcendent importance for political, strategic, and trading purposes, need not be too much insisted upon in this place, so obvious must they be to every one. Yet, great as has been its power and advantage in all of those directions in the past, it is certain that still greater development and still greater service to the world will follow in the future even from existing systems, not to speak of their certain and enormous possibilities of growth. In the celerity of the actual despatch of a message we need not ask for much improvement. Lightning speed will be probably sufficient for our go-ahead children of the twentieth century. But where we may expect and shall undoubtedly get increased success, is in multiplied facilities for sending telegrams all over the Earth, and in widening their usefulness and convenience to all ranks and sections of the community. To obtain these necessary advantages there are two requisites—first, a great and general cheapening of tariffs, and, as a certain consequence of such reduced charges, a duplication, or even a quadrupling, of many of the present cables to prevent blocking; and, secondly, an indefinite extension of both lines and cables everywhere. Progress in submarine telegraphy undoubtedly means a lessening in the price of service and a firmer control by the State, as an obvious corollary to the large help to the companies already given by the general taxpayer, quite as much as it means those scientific inventions and scientific discoveries which the coming years have in store for us. At the present time the charges are far too high, ridiculously so as regards India, and the use of the great cables is therefore very often beyond the power of the small capitalist and the trader of

the middle sort. Yet certain and early news is of supreme importance to large numbers of both classes. Its absence hampers or stops business, while its price is too severe a tax upon average profits. This fact has led to the invention of ingenious and elaborate codes. They might possibly have been devised in any case; but there is no doubt that messages by code would be certainly expanded so as to prevent all possible ambiguity, if telegraphing to distant countries were not so costly. The spreading of land-lines and sea-cables about the Earth has gone on rapidly since 1870; to the extent that those already completed would seem even to be in advance of their requirement, if that requirement were to be measured by their full employment. Nevertheless, it is to be wished that new companies could be formed and new lines laid down to excite competition, and thereby to cheapen rates; or else that our Government should step in and regulate charges over subsidized British lines. For the power of the great telegraph corporations, by reason of their monetary resources, enables them to overcome ordinary rivalry and to treat public opinion with indifference. A general cheapening of rates has constantly been followed by increased profits, earned by the resulting augmentation of traffic, but it needs an enterprising directorate to face the necessary initial expenditure, except under pressure. Boldness and foresight in finance are naturally less prominent features in the management of the great telegraph companies than contentment with a high rate of interest on invested capital. All their energy and watchfulness are employed to crush competition rather than to extend their activities indefinitely. Moreover, money-making is their business, not Imperial statesmanship. If it were a question of the added security or the close coupling-up of the Empire (which are probably synonymous) on the one hand, and a loss of profit (however splendid the dividends might still remain) on the other, we know what would be the result of their deliberations.

Important as are the sea-cables for statesmen, for strategy, and for commerce, they are or will be equally important socially to keep up intimacy and swift intercourse between families half in Britain and half in India, for instance, or between friends and relations in these islands and in the great colonies. They might be made to give the sensation almost of actual contact, of holding the hand of your friend, of speaking directly to his heart. It is this interchange of personal news and private wishes, quite as much as the profound political and commercial aspects of lightning communication with all parts of the Empire, which will bind the Empire in bonds stronger than steel, easy as affection, to hold it together with unassailable power. Consequently the health and strength of the Empire depend very greatly upon a cheapening of telegraph charges. Doubtless a time will come when all our main cables of the first importance will be in the hands of Government, when they will only touch upon British territory, and when they will be all adequately protected from an enemy. Those are truly Imperialistic and patriotic aspirations. But we must never forget the grand part in bringing together, within whispering distance as it were, the different parts of the world, and consequently of our world-wide Empire, which has been taken in the past by such Napoleonic organizers as the late Sir John Pender. It is to him and to such men as he that we owe those splendid beginnings which by means of vital reflexes from the nerve-centre of the Empire have helped to fire our white fellow-subjects all over the globe with a loftier patriotism and with new, brave, and broader ideals of nationality.

Coincident with the opening of the Suez canal in 1869 the liveliest interest began to be taken in sea-cables, and a master mind perceived their commercial possibilities. Before that time the success of the constructing companies had not been great. Sir John Pender then founded the famous Eastern Telegraph

Company by the amalgamation of four existing lines, which had together laid down 8500 miles of sea-cables, besides erecting land-lines also. A year later, in 1873, from three other companies he formed the Eastern Extension Australasia and China Telegraph Company, which jointly possessed 5200 miles of submarine lines. From that date the extension of electric communication to all parts of the earth, over wild as well as over civilized countries, and beneath the salt water, has only been equalled by their average remunerativeness. Now there are 175,000 miles of submerged cables alone, of which this country owns no less than 113,000 miles. The history of some of these cables is full of interest, and might attract the delighted attention of the lover of picturesque romance no less than of the student of commercial geography. It also supplies suggestions and many facts, both to the physical geographer and to the student of seismic phenomena. Science has taught the companies to economize time, labour, and material in cable-laying operations, as well as how to improve the working instruments. Human ingenuity, business perception, and organizing power have shown once more their startling possibilities when directed and controlled by cool, clear-eyed intelligence combined with general mental capacity.

It is only necessary to reaffirm, for the reasons already given, the national, the imperial, the commonwealth requirement for cheap telegraphy, and the profound necessity there is, both strategically and politically, for complete Government control by purchase, guarantee, or other equitable means over main cables which connect Great Britain with her daughter states, her Indian empire, and her dependencies. Our communications with our own folk must be independent of private companies and completely independent of all foreign nations.

All the details which I have given are illustrative of man's successful energy and of his progressive ingenuity in enslaving the great forces of the earth to diminish distance, to shorten world-journeys, and to speed world-messages. Another human achievement, the piercing by Lesseps of the Suez isthmus, has had remarkable consequences. It had been talked of in England centuries ago. Christopher Marlowe makes Tamerlane brag—

> "And here, not far from Alexandria,
> Whereas the Tyrrhene and the Red Sea meet,
> Being distant less than full a hundred leagues,
> I meant to cut a channel to them both,
> That men might quickly sail to India."

The illustrious French engineer solved one great problem in 1869, only to originate others which are of profound importance to commercial geography—and of the British Empire most of all. The Suez canal has brought India and the Australasian Commonwealth wonderfully near to our shores. It has greatly diminished many time-distances, but why has it not injured our Eastern trade? Also is there any danger or menace of danger to that trade? From the very beginnings of the great commerce, the Eastern trade has enriched every nation which obtained its chief share. It has been the seed of the bitterest animosities. It alienated Dutch and English, blood relations, co-religionists, co-reformers, into implacable resentment, and bitter has the retribution been. On the other hand, it brought into temporary alliance such strange bedfellows as the Turks of the sixteenth century and the Venetians. At the present day what international jealousies and heartburnings has the same rivalry not fostered! For all the trading peoples know how vital is that traffic.

In the earliest days of commercial venturings the Eastern trade focussed at Alexandria, afterwards at Constantinople and the Italian "factory" stations of the

Eastern Mediterranean. Barbarous upheavals in Central Asia interrupted the current at times, but only as temporary dams. Then came Vasco da Gama's voyage round the Cape and its sequels—the diversion of the rich merchandise of the Orient from the Italian ports and from the Eastern Mediterranean to the seaboard cities of the Atlantic. Out of the relentless scramble of the Atlantic nations for this, the grandest of the trader's prizes, the English came out bloodily triumphant, and the British have remained the dominant shippers ever since. But when the Suez canal was trenched through, a geographical reversal followed: the merchant's chief path may be said to have left the Cape circuit and to have regained the old line, with immensely added facilities, to debouch upon the Eastern Mediterranean. Why has it not affected us more profoundly? Are not geographical canons outraged by the great steamers passing by the French and Italian ports to find distributing centres in these islands? I think that theoretically it is so, even admitting that the foreign harbours are more difficult than ours. Practically only a few industries have suffered; the volume of our trade has increased greatly, and it still remains easily pre-eminent. One of the chief explanations I believe to be this: Geographical considerations were defeated, for the time at any rate, by the excellence of our banking system when the Suez canal was opened. The wealth of the country, then as now, instead of being separated and divided into isolated patches, was accumulated in the hands of bankers and was readily and easily available for commercial enterprises. So the necessary steamers—huge, and of special line—were built at once by our companies and launched into the valuable Eastern trade before their rivals could begin to stir. This country had the invaluable help of its monetary facilities. Wealthy shipping corporations, once fully organized and successful, have great power, by reason of their reserves and resources, to hustle and to ride off the attacks of weaker and less-experienced competitors. Supposing this great change had but just occurred —our advantages, though still distinct, would have been less remarkable. And in the future international trade jealousy will be keener and the competition even more severe. We must not forget that our geographical position is no longer in our favour for steamships plying from the East, and, as in the immediate past, we must throw away no chances, but seek to make up for that admitted defect by defending and supporting that admirable system—our national banking system —which has carried us over seemingly insurmountable obstructions to brave trade triumphs.

The general considerations which I have named might lead to the inference that actual geographical disadvantages, in trade competition for instance, may sometimes be conquered by man's resourcefulness and energy. Within obvious limitations that is certainly true. At places, as we know, the borderland between geography and many of the natural sciences is often vague and confusedly interlaced. So perhaps also with mechanical and economic science our boundaries at certain spots overlap. Quick steamers, far-reaching telegraph lines, and the piercing of isthmuses by ship canals may at the first glance appear outside the purview of the geographer. Yet from that particular aspect of geography which I have already spoken of as the Science of Distances we perceive how relevant they are, how worthy of study. Truly ours is a very catholic science, and we have seen how even the comparative value of national banking systems may help to explain seeming geographical inconsistencies, to reconcile facts with possibly unexpected results, and to show how the human element modifies, perhaps, the strictly logical conclusions of the geographer intent upon physical conditions alone. It is for the statesman and the philosopher to speculate upon the character and the permanency of such influences. Our success as an Empire will probably

depend for its continuance upon a high level of national sagacity, watchfulness, and resource, to make up for certain disadvantages, as I think, of our geographical position since the cutting of the Suez canal; and it will also depend upon the comprehensive and intelligent study of all branches of geography, not the least important of which to my view is the Science of Distances—the science of the merchant, the statesman, and the strategist.

THE ORIGIN OF LAND-FORMS THROUGH CRUST-TORSION.

By M. M. OGILVIE GORDON, D.Sc., Ph.D., LL.D.

CRUST-TORSION has already been recognized as a mode of crust-deformation associated with the superposition of different movements upon one another, either simultaneously or successively. But its appearances in the field had been referred more especially to cases of rectangular cross-movement, or, as some writers expressed it, to the action of end and side pressures.

In 1898, I demonstrated, by the field geology of Enneberg, that phenomena of crust-torsion were induced by *any combination of crust-pressures, not only by cross-movements crossing rectangularly, but also by cross-movements at any oblique angle.*

Without entering here into the original cause of crust-strains, it is within the experience of geologists and physicists that any deformation of a flexible sheet of material due to a lateral thrust or pressure will set up internal strains of warping traceable to some inequality in the strength of the material and to consequent local differences in the resistance offered to the deforming tangential strain.

The least complex case of differential movement can be illustrated by the behaviour of such a material as a wooden lath supported at both ends, and bent by being either loaded by a weight at the middle (Fig. 1), or by end thrusts directed along its length. As every one knows, the upper layers of the wood are subjected to compression, and the lower to tension; consequently we find that the uppermost surface, AB, of the lath is shortened in length, and the lowermost, CD, is increased in length. Here the differential movements of the layers of a uniform material have given rise to a decrease of surface at one place, and an increase of surface at another.

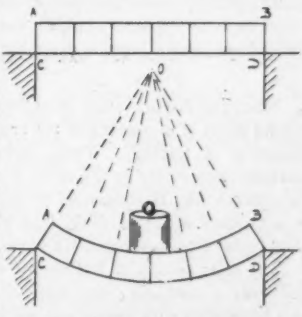


FIG. 1.—BENDING AND WARPING OF A LATH LOADED AT THE CENTRE WITH A WEIGHT.

The deformation of such a lath would correspond to the formation of a trough. A similarly deformed lath would, if inverted, correspond to the formation of an arch. Lines such as AC and BD, which were originally vertical, have got deviated into such a position that they would, if produced, meet in such a point as O (Fig. 2). Similarly, AC and EF would, if produced, meet in P. In short, points which were arranged in vertical parallel lines before the deformation of the lath would, after deformation, be arranged in lines which meet radially in such centres as O or P; such lines have therefore undergone a movement of rotation in a vertical plane. These laths are deformed in a vertical plane because they are weakest in that plane.

Continuing the lath illustration, suppose a lath turned on its side. Then, if its ends were subjected to compression, the lath would be deformed, but this time in a horizontal plane, because it is weakest in this direction. Such lines as AC and BD, which were horizontal and parallel before deformation, would get deviated in a horizontal plane into such a position that they would, if produced, meet in a point like O. Similarly AC and EF would, after deformation, meet in a point like P.

If these two movements, the one a turn in the vertical and the other a turn in a horizontal plane, were combined, such lines as AC and BD would describe cones, and each point in these lines would be twisted or move in a spiral. When a sheet of material is built up of layers heterogeneous both in vertical succession and in horizontal extension, it is most certainly unequally strong in different directions. Whence, if subjected to horizontal compression in any one direction, the general movement of any one part of that sheet will consist of a combination of a horizontal and vertical turning movement—that is, *motion in a spiral.*

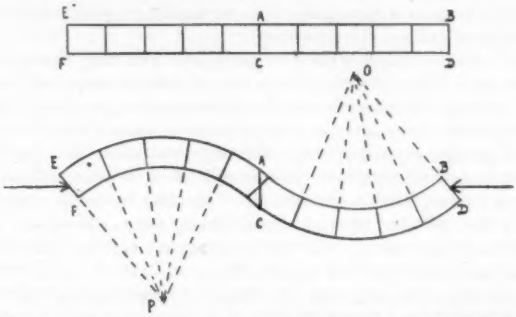


FIG. 2.—BENDING AND WARPING OF A LATH SUBJECTED TO END COMPRESSIONS.

Since the Earth's crust is everywhere heterogeneous, the spiral is the fundamental mode of movement in the crust. Observe that this is independently of any repetition of folding. When, however, repetition of folding *does* take place, increased complexity in the spiral movements ensues. Any subsequent differential movements may be influenced by the development of local places of weakness due to a primary series of folds, thus rendering such movements more marked than would arise from heterogeneity alone.

The older system of folding and fracture may be regarded as a floor with lines and areas of weakness; any material which is laid down on the floor, is really laid on a foundation with strong and weak places. If now a new set of forces come into operation, the structure, consisting of floor and material resting on it, will yield readily at these places of weakness. Thus the material which has been laid down in the interval between the first and second foldings will have its movements determined by both foldings.

It is clear that in a region like the Alps, which has in its separate parts suffered from repeated folding movements, the complications due to cross-movements must be very involved.

In Enneberg, in South Tyrol, I regard the torsional phenomena as prominently developed, both because in that area the layers of the Permo-Triassic sheet of deposits offered strong contrasts in strength, and because the whole post-Permian series had been laid down upon an already folded and fractured floor, namely, that of the

Permian Alps. I showed in Enneberg that the original horizontal, vertical, or oblique limits between groups of softer deposits and more rigid calcareous or dolomitic rock-masses had been pre-eminently planes of local differential movements during the regional Alpine movements, and were still, in many places, characterized by the continuance of crust-fractures, or by frequent surface-slips. Accordingly, the original distribution of the more rigid and the more plastic deposits was a matter of the utmost significance for the subsequent history of deformation and denudation.

The geological succession of the Upper Triassic deposits is remarkable in the Eastern Alps for the very great differences in the lithological character of contemporaneous sediments, and in the faunas comprised within them. The particular development within each geographical district is termed a particular local "facies," and the geographical district is termed a "province." In Enneberg, the local facies of deposits in the earlier eras of Upper Trias comprises a mixed series of volcanic tuffs and marls, shales, sandstones, together with limestone and Schlern dolomite. On the other hand, the facies of the contemporaneous deposits south of Enneberg is almost wholly calcareous or dolomitic, and is known as the "Schlern dolomite" facies in contradistinction to the tufaceous facies of Enneberg. Both these facies pass upward into various local developments of "Raibl" marls and shales, succeeded by the highest horizons of the Upper Trias, namely Dachstein dolomite. All groups of Triassic rock, both the less yielding and the more yielding, varied rapidly in thickness in Enneberg.

Another important intermixed series of deposits is the Liassic group, succeeding the massive and less yielding Dachstein dolomite of Upper Trias. During the post-Jurassic regional movements of Alpine upheaval, the harder masses exerted subordinate pressures on the softer. "The harder rocks of Schlern and Dachstein dolomite have sometimes been pushed into new positions over the slipping substratum of earthy rocks without in themselves undergoing much relative change of position or perceptible evidence of strain, except where complications are introduced by minor thrusting and faulting along the main planes" (*Geol. Mag.*, 1894, "Coral in the Dolomites").

Local differential movements had also been set up between Enneberg and the adjacent area on the south, which exhibited the calcareo-dolomitic facies, the northern area having sunk relatively to the southern. The mixed tufaceous facies of Enneberg extends along the north of an ancient zone of fracture, in which considerable masses of lava and tuff occur, partially of Triassic age, partially of the younger ages of Alpine movements. In addition to the existence of an old zone of crust-movement, the marked differences of the Triassic deposits on the north and on the south of it tended to make these contiguous areas of deposit act in a measure independently of one another during any future oncoming of movement.

The above examples of the modifying influence that may be exerted upon a regional movement by local strains due to local conditions are furnished upon personal evidence. A third example may be selected from the general literature of the Dolomites. It shows how the presence of the Permian quartz porphyry in the Bozen area affected adjacent areas during Alpine upheaval.

The general stratigraphical relations of the quartz porphyry are thus described by Prof. Suess: "Towards the south and towards the north, older formations appear below the porphyry; towards the east and towards the west, the porphyry descends below younger formations. . . . The younger deposits resting on the porphyry on the east side, form that part of South Tyrol famous for the beauty of its landscape, and which has been somewhat erroneously termed the "Dolomites." The western edge descends more steeply below a long and narrow fault-block of

deposits, assuming in some parts the form of a flexure overcast towards the west. The fault-block of deposited material embraces *the whole succession from Permian to Middle Tertiary*, and is lowered into a great crust-trough between the flexure on the western edge of the porphyry and the Judicarian fault-line" ('Antlitz der Erde,' Bd. i. p. 330: the italics are mine).

The position of the porphyry relative to the older strata on the north and south indicates compression of this area from north and south, a compression which was shared by the adjoining areas of the Etsch valley and the Dolomites. On the other hand, the position of the porphyry relative to the younger strata on the east and west shows that differential movements took place locally in cross-directions at the limits between the hard porphyry mass and other less resisting rock-material next to it.

Hence this example is in harmony with one of the writer's conclusions in Enneberg, that local torsional effects arising from cross-movements between dissimilar masses of strata or unequally yielding areas have, in the Alps, been superinduced upon fundamental east-and-west or "regional" axes of deformation. It is a separate question in how far the local strains were synchronous with the more general movement, or if the local strains were earlier or later.

Such a question can only be decided on the merits of each individual case; in the case of the Bozen area, an index of the age of the cross-movements is given in the lowering of middle Tertiary strata within the trough west of the porphyry; since, at whatever time the local differential movements may have begun, they have been in progress since the deposition of middle Tertiary rocks. In the case of Enneberg, there is clear evidence that a general east-and-west folding and faulting of the strata has taken place subsequently to the deposition of all the Mesozoic horizons of rock exposed there. The whole series also shows the folding and dislocating effects of cross-strains, mainly from west-north-west and east-south-east, while the results of more local horizontal, oblique, and vertical differential movements are variously exhibited in the different horizons of rock. It follows that there has been in Enneberg compression and cross-compression. Upon mechanical principles, the resultant effect of superinduced strains is the same, whether the several strains develop simultaneously, or successively, or intermittently, and it has been explained above how superinduced crust-strains in different directions would inevitably cause resultant displacements in the same sense as would be effected by twisting or "torsion" of rock-layers and rock-particles.

It may probably be regarded as true of any wide region upheaved by a folding-movement and afterwards submerged, that old crust-forms and crust-fractures, especially such as allow occasional intrusion and outlet of volcanic material, are determining factors in the distribution of the subsequent deposits. They largely determine the irregularities of the sea-floor, the varying depths of adjacent basins, the local deflections of oceanic currents and the distribution of warmer and colder water, the wash of breakers, and other local conditions which influence the distribution of pelagic faunas (cf. Sir John Murray, *Geogr. Journ.*, July, 1899). And in this way, by local demarcation of lithological and faunal facies, local idiosyncrasies having reference to older surface-forms are imprinted upon a region for all time.

With the oncoming of another movement of upheaval from the same direction as the earlier movement, or from any other direction, the boundaries of facies laid down in that region during the previous ages of deposit are specially liable to become zones or planes of differential movements, although the individual facies can only exert local modifying influences. Hence incidents of folding and faulting, of intrusion of igneous rock, of subaërial and submarine denudation associated with an

earlier upheaval are the basis directly and indirectly of subordinate or local systems of crust-strains which interfere with the main system of strains governing a later upheaval, and are concentrated along old depositional and structural limits.

During the progress of the new regional movement, the new axes of deformation determine new boundaries of facies, and these new boundaries of different deposits or of intrusive and sedimentary rocks offer additional planes of differential movement that take effect as the movement progresses.

For example, the Cretaceous epoch is regarded as the second great mountain-forming period in Alpine history, and during it both longitudinal and cross-faults are said to have been developed, more especially in the Eastern Alps. Austrian geologists are of opinion that the deposition of Upper Cretaceous rocks in certain parts of North Tyrol was localized in accordance with the previous development of important Cretaceous fault-lines, also that these faults were afterwards zones of marked deformation during the farther upheaval of the "limestone and dolomite" region of North Tyrol. This case offers analogy with certain points that I demonstrated in Enneberg, (1) in respect of the localization of facies in the vicinity of Triassic faults; (2) in respect of the tendency of any later movements in the same region to be influenced by the old lines of fault.

But still other agencies have to be considered besides these of sedimentation during the new movement. For as the Cretaceous and Tertiary lands emerged in the Alps, they were subject to the processes of denudation and to subsidiary movements of crust-adjustment following upon these. The complications of cross-movement were therefore bound to increase as the history of upheaval and denudation went on side by side, and the actual crust-forms shaped during the Cretaceous and Tertiary epochs could not be other than complex resultant forms, combining effects of differential movements accomplished in virtue both of older and newer boundaries of deposits, directions of crust-weakness, and influences of surface-erosion.

As early as 1894 I had pointed out that the Cretaceous-Tertiary movements only in so far followed the main lines of the Triassic movements, that they also crossed these at various angles. Further examination and mapping showed me that radiating dykes were associated with characteristic "bundles" of faults and with curvatures of the strike developed in the Cretaceous-Tertiary epochs. The complications corresponded in essential features to the structure which Prof. Lossen had worked out in the Harz, and had there attributed to torsional crust-movement. Many other complexities in Enneberg, such as the minor thrusting in oblique directions across a main overthrust, the disposition of the outcrops of rock-horizons in sigmoidal or S-shaped curves, and in whirl-shaped figures generally, the gradations of strike in diverging fault-blocks, the rapid variation in the angle of inclination of fault-planes, and frequent forking and intersection of faults, indicated a solution based upon principles of crust-torsion.

I then formulated certain definite principles of crust-torsion which seemed to explain the present complicated structural relations in Enneberg—the leading principle being that in Enneberg we have not a simple lateral thrust to deal with, but the resultant effects of different lateral thrusts differing in intensity and crossing one another.

It had been hitherto accepted in Alpine geological literature that the lateral pressure which led to the upheaval of the Alps in Cretaceous and Tertiary time came from one direction, mainly from the south, and caused upfolding of Alpine territories in a general system of east-and-west folds, associated with gigantic crust-creep of overthrust masses, more especially towards the north on the northern edge of the Central Alpine chain, and in less degree towards the south on the southern edge of the Alps; the whole structure had also been dislocated by

longitudinal and transverse faults, some of which were older, others younger, than the folds and overthrusts.

In agreement with this, I found that *all* the rock-deposits in the Alpine district which I examined had been subjected to compression from north and south, and folded in a general fundamental system of east-and-west folds. But I also found that this system had been crossed by a transverse or slightly oblique system of anticlines and synclines, and subjected to extreme deformation and distortion from cross-directions. The longitudinal folds had been steeply tilted, or "overcast," *i.e.* laid over into more horizontal positions, or fractured, and the parts carried into different oblique directions. Associated with the cross-compression new folds had formed, and overthrust masses had travelled in transverse and various oblique directions. Within the Dolomites, where I worked, I found

FIG. 3.—WEDGES OF LOWER AND MIDDLE TRIAS ABOVE THE PLANE OF OVERTHRUST IN BUCHENSTEIN VALLEY, VIEWED FROM THE SOUTH.

that in several cases overthrust slices had crept obliquely across the smaller folds and crumples of intensely-crushed underlaid masses, which had been dragged out and tilted slantingly upon one another in wedge-like fragments, representing subsidiary overthrusts accompanying the major overthrust.

An example of such oblique shearing is given in the photograph of an outcrop in the "Buchenstein" overthrust south of Enneberg, in the Dolomites (Fig. 3), which is interesting also in showing igneous rock-material injected into these planes of fracture and shearing.

The photograph Fig. 4 shows a highly characteristic effect of cross-compression upon the dolomite rocks. The cliff in the photograph is composed of dolomitic strata which form part of a longitudinal arch, the strata being tilted so that the planes of bedding incline at an angle of about 20° to the north. Far more apparent than the planes of bedding are the planes of separation which cut

the bedding planes almost vertically, and extend in north-north-west—south-south-east direction, indicating the action of lateral pressures along east-north-east and west-south-west direction.

The photograph Fig. 5 represents a small part of the eastern transverse arch of the mountain massive of Sella, in Enneberg; this arch comprises several *transverse* folds and fractures, indicating the action of lateral pressures transversely across the east-and-west systems. The western transverse arch of Sella faces Langkofl mountain, so well known to climbers; it shows nearly undisturbed horizontal stratification, being part of a wide arch deeply cleft and jointed (Fig. 6).

These are only a few examples of the simpler observations that can be made on cross-movements in the Dolomites. The difficulty that attends the elucidation of the complex resultant system of folds and overthrusts is due to the presence of a

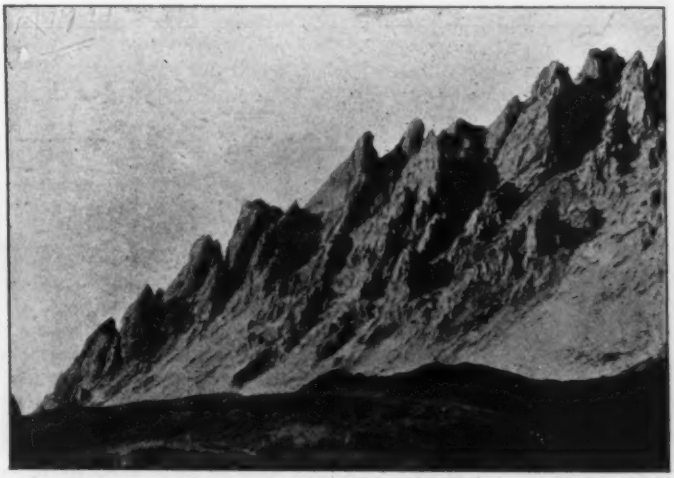


FIG. 4.—SLABS IN SCHLERN DOLOMITE ROCK, PRODUCED BY CROSS-PRESSURES: SPITZ-KOFL GROUP FROM GRÖDEN PASS.

network of fault-planes, highly inclined or vertical, that have dislocated the series of folds and overthrusts, and displaced them in vertical and horizontal senses. The Sella mountain has subsided in several "fault-blocks" since the epoch of overthrusting, so that in its case faulting and erosion have only left incomplete remnants of the structural forms that were assumed by the upper horizons of the rock-series in the Dolomites. It is therefore chiefly in the lower horizons of the series exposed in valleys and high meadowlands that we have to seek fulness of detail; both at Gröden pass and in Buchenstein valley convincing evidence may be observed of the action of differently directed movements in the course of Alpine upheaval (cf. "The Torsion Structure of the Dolomites," 1899, *Q.J.G.S.*).

The leading faults of adjustment are of wide extent, continuing beyond the limits of the district examined; several of these converge in the interesting "eruptive centre" of Predazzo. The faults associated with the local subsidences and surface-slips more especially attest the influence of local differences in the character of the contiguous rocks, *either those which were originally next one*

another, or those which had been brought by the previous complex movements of bending and thrusting into juxtaposition with one another. It would not be accurate to describe even the leading faults simply as a system of longitudinal faults crossed by transverse faults; they present varied arrangements in fault-bundles and fault-polygons, and, like the joints and the greater and finer separation-planes through the rock, intersect each other, or subdivide into forking branches of less importance.

The general effect of these adjusting movements in the Dolomites has been to depress the whole region, cutting it up into numerous fault-blocks, some more, some less depressed. Thus we have evidence that during the chief epochs of folding and overthrusting in the "Dolomites" the whole region stood much higher, and now represents a sunken and fragmented Alpine "central massive."

The transverse and oblique folding and overthrust movements have affected

FIG. 5.—PORTION OF THE EASTERN TRANSVERSE ARCH OF SELLA MOUNTAIN IN THE DOLOMITES, VIEWED FROM THE EAST ON CAMPOLUNGO PASS. SD = SCHLERN DOLOMITE.

Eocene and even Oligocene strata within South Tyrol, and must therefore have been in progress during the Oligocene and Miocene geological epochs; while the faults that have displaced the folds and overthrusts may have originated at various periods, but certainly must have been also later than these epochs of overthrusting.

We seem, therefore, bound to refer these displacements and adjustments at the earliest to the Miocene eras, when the loading and unloading of rocks that had been in process both by dynamic and subaerial agencies of denudation had considerably altered the earlier conformation of the uplifted system. From the evidence of the subsidences in the Dolomites, it is particularly to this adjustment phase that we may refer the *relative downthrow of the limestone and dolomite ranges, and the relative uplift of the central massives and central chain of the Alps generally.* The subsidence of the lateral chains enabled the outward creep of masses of rock to take place from the central chain over the limestone and dolomite chains, and further overthrusting movements from areas of uplift over troughs both within the Alps and on the outer zones, in which Oligocene and

Miocene deposits had already gathered. Thus it is necessary to decipher one set of movements superposed upon another again and again in the long history of the Alpine upheaval, and the actual relations that we now see are *resultant* relations.

This undoubtedly presents the most involved picture of the Alpine upheaval which has yet been given, but it may seem simpler if analyzed with the aid of the above illustration of the compression of a lath in different directions, and the effects of cross-warping that inevitably ensue. Let us suppose, instead of the lath, a series of sedimentary deposits of uniform character subjected to lateral pressure from a certain direction. Then, with the beginning of compression, the tendency is for the layers to be least disturbed in their relative position at the "crests" of arches and the "kernels" or hollows of troughs, and to assume a tilted position in the "middle limb," or intermediate part between an arch and a trough. The

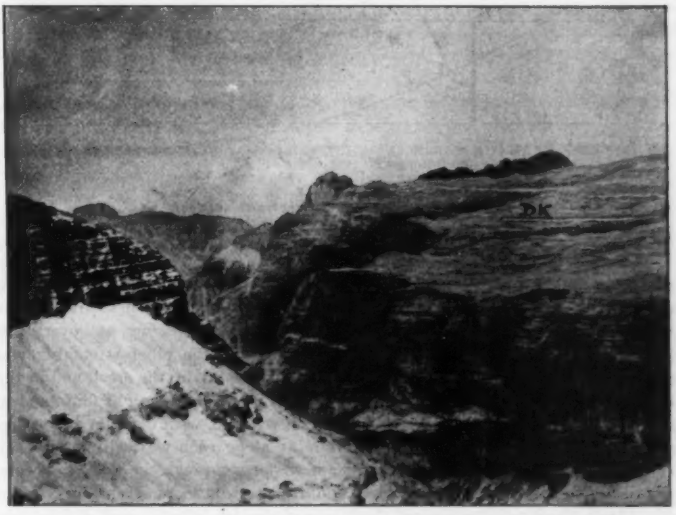


FIG. 6.—PORTION OF THE WESTERN TRANSVERSE ARCH OF SELLA MOUNTAIN, IN THE DOLOMITES (TOWARDS VAL DELLA STRIES). DK = DACHSTEIN LIMESTONE OR DOLOMITE. R = RAIBL STRATA. VIEWED FROM THE EAST, NEAR THE BAMBERG SHELTER HUT BELOW BOE SUMMITS.

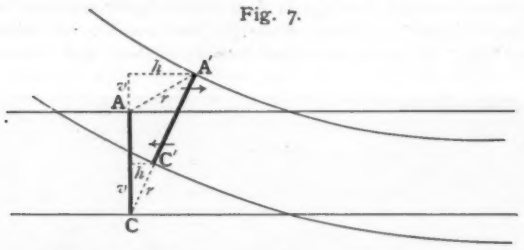
tilting of the series implies that, accompanying the vertical translation, there is a lateral displacement in rotatory sense of any vertical row of particles composing the several layers, the particles being displaced relatively to their own original position and relatively to one another.

In Fig. 7, let the points A and C in the vertical line AC represent the original position of the uppermost and lowermost particles, and let A′ and C′ be the altered positions of the points after some period of lateral compression. At first, before the series is much shortened in its horizontal extent, the point A turns to the right, C to the left of their original positions; but with increased compression and subsequent farther shortening of the series, both the points A and C may move to the right of their original position, A, however, relatively farther than C. Clearly under compression there is relative differential movement between A and C. The

horizontal components (h) and the vertical components (v) of the resultant displacement (r) are different for the particles in the upper and lower horizons, the lower horizons in Fig. 7 being retarded relatively to the upper horizons. If we turn the figure upside down, it represents then part of an arch in which the upper horizons have been retarded relatively to the lower.

As compression continues (cf. Fig. 2), the tendency will be for the upper horizons to keep slipping partially over one another and accumulating in the trough or inthrow area; and with increased intensity of lateral pressure, the chief

Fig. 7.



AC. *original position*
AC'. *altered position*
h. *horizontal,* v. *vertical,* r. *resultant, displacements*
⟹ *differential strains*

crush effects in the upper horizons would be within the trough, the chief crush effects in the lower horizons would be in the body of the arch, while in the intermediate area between arch and trough, the sliding, shearing, and overthrust effects would be chiefly presented. At the same time, the chief stretching and rending effects would be in the upper horizon of a series in the crest, and in the lower horizons of the same series in the trough. There faults might form, and in some cases igneous intrusions might become intermixed with deposits and crush-breccias. On account of the differential strains along each vertical line (Fig. 7), there is the tendency for inclined fault-planes to form through the midway points, therefore to hade inward to the trough, and to intersect more steeply inclined or vertical fault-planes passing through the intermediate area between arch and trough.

If the horizontal compression becomes very great, one or both arch-crests on opposite sides of a trough may bend back above the trough at the intermediate area. Then more complex results are obtained; inclined fault-planes with downthrow towards one trough may be parallel with reverse fault-planes upon which a portion of an arch has moved backward over an adjacent trough; oppositely directed reverse fault-planes may form, or an earlier series of arches and troughs may be cut by later reverse planes and the advance of overthrust rock-masses. It follows that these groups of intersecting planes of fault must be presented with which geologists are familiar in the sections of highly disturbed regions.

In accordance with the lath illustration, let the sheet of deposit be subjected afterwards to lateral compression from any other direction, let the conditions of strain be varied in any appreciable degree, so that we have a resultant system of displacements combining different systems that have acted over the whole sheet of deposit. Under such conditions of regional cross-compression, the most striking effect obtained—even upon theoretical grounds—would be that of centralization, since all the possibilities that arise under intense lateral compression from one

direction are also true for the effects of lateral compression from the oblique and transverse directions.

So long as Alpine geology was based upon the principle of lateral pressure acting from one direction, no sufficient structural explanation of an Alpine central massive was forthcoming. Accepting the principles of cross-compression, the "fan-shaped structure" of the central massives, and generally the "whirl-shaped" figures in the conformation of the Alps and in the conformation of the mountain systems round crust depressions of Southern Europe, find as natural an explanation as the whirl-shaped forms in the region of the "Dolomites" which I examined.

The same modes of deformation that are accomplished on a grand scale by the action of varying cross-strains due to regional causes and acting over wide regions, are accomplished on a smaller scale by the local action of these subsidiary cross-strains arising from differences of resistance exerted in different directions with a sheet of heterogeneous rock-material. The combination of any subsidiary with any major movement produces a resultant local deformation, and the proportional intensity of different strains must be subject to all manner of local variations during the progress of regional movement. In short, consistently with what I have seen in the Dolomites, I am of opinion that all crust-deformation due to lateral compression is accompanied either locally or over wide regions by cross-movements, and presents corresponding resultant displacements of rock-masses, layers, and particles.

In a paper read at the Dover Meeting of the British Association (September, 1899), I compared the superposition of subsidiary crust-movements upon greater crust-movements, or generally of two or more different movements upon one another, with the familiar case of "Harmonics" in physics. As that paper has not been published, the following passage is quoted:—

"The fundamental structural form of the Gröden pass is that of an arch, while the fundamental form of the opposite mountain massives is that of a reciprocal trough on either side of the Gröden pass arch. The distortion of the fundamental forms has been caused by the tendency to the superposition upon the major forms of other subordinate or cross-forms due to subordinate or cross-strains; so that the present conformation of the surface on that area may be described as a *resultant* conformation. Similarly, what is designated a Central Massive in the Alpine mountain-system bears upon it numerous subordinate crust-forms due to subordinate movements, and a major trough or 'basin' in the Alpine system comprises numerous subordinate arches and troughs. The 'dolomite' district of South Tyrol, for example, is a crust-basin, which is incorporated in the Peri-Adriatic area of subsidence, but itself comprises numerous local areas of subsidence (such as Sella Massive and Sett Sass), demarcated by local areas of uprise (such as Gröden pass and Campolungo pass).

"Again, the great Alpine massives and Alpine basins are themselves component parts of the *regional* uprise represented by the mountains of Southern Europe as a whole in their relation to adjacent areas of relative depression.

"This aspect of the structure of any great mountain crest or system presents a suggestive resemblance to a diagram of the condition of a medium transmitting a complex sound, such as that of a musical note with several harmonics (cf. Fig. 8 from Fourier). . . . Indeed, the complications of geological structure that may result from successive or simultaneous applications of simple lateral pressure are such as in the end to produce a map as little suggestive of simple anticlines and synclines as the diagram of the medium transmitting a musical chord is of several diagrams representing the effects of the constituent notes.

"We have, in studying the Alpine system of crust-forms, to keep well in view

the 'interference' of smaller movements with greater; the tendency to the superposition of movements affecting any two subjacent layers or horizons of the crust upon folds affecting greater thicknesses of the crust or complete crust-blocks; likewise the tendency to superinduce folds within a small area upon folds extending over a wider area; more generally, the tendency to superinduce cross-folds at various angles upon longitudinal folds, or any different series upon one another; and the consequent development in the crust of characteristic series of torsional phenomena varying in accordance with the complexities of the cross-movements.

"In case any one should question if cross-folds can tend to form simultaneously, I shall merely indicate the line a reply would take. We have to remember that at any one locality there may be a fundamental folding movement taking place in virtue of a great regional set of earth-pressures, and at the same time subsidiary folding, sliding, and shearing movements taking place in virtue of local pressures. It is true that any territory folded in such a way would indicate folding around

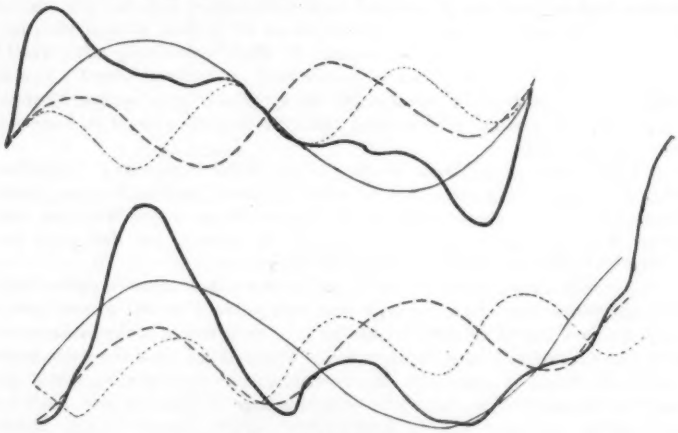


FIG. 8.—RESULTANT WAVE-FORM.

resultant. ..... vibr. 2) partial tones or overtones.
vibr. 1. - - - - - vibr. 3)

Actual resultant wave formed during the simultaneous propagation of the simple waves corresponding to a note, its octave, and its twelfth (two phases shown).

definite centres, and bring us back to one of the most famous theories of Alpine upheaval. The better appreciation, however, of the 'resultant' of differential strains in any part of the Earth's crust undergoing deformation brings us in these days back to the general conception upon a more precise physical basis."

Those who are familiar with the mechanics of a wave, compounding two or more simple harmonic motions, will at once realize how many different forms of spiral and elliptical paths of movement might be described by earth-particles under the influence of superposed and intersecting movements; farther, how the directions of such paths might be related to one another as positive and negative, and the resultant strain in some places be a neutral strain, in others a positive strain, in others a negative strain.

Hence two of the results of the writer's observations in Enneberg, namely, that *torsional displacements have been performed in relative, positive, and negative direc-*

tions with reference to local foci, and that these displacements have taken place in virtue of superposed movements, conjointly verify for dynamic movements in the Earth's crust the general conception of phenomena of "interference."

To sum up, each rock-particle in the Earth's crust, when under the strains of lateral compression, behaves (1) as an individual bearing dynamic relations to neighbour individuals; (2) as an integral part of a rock-layer, facies, or mass bearing dynamic relations to adjacent and subjacent rock-layers, facies, or masses respectively; (3) as an integral part of a locality or region of the Earth's lithosphere bearing definite dynamic relations to the localities or regions next it; (4) as an integral part of a superstructure whose floor is in many places molten, and therefore plastic.

A disturbance in any one of these dynamic correlations carries with it a disturbance in the others. The action of a simple lateral thrust over a wide region during regional crust-compression is scarcely conceivable under these complex conditions of correlation.

THE PETTERSSON-NANSEN INSULATING WATER-BOTTLE.*

By HUGH ROBERT MILL, D.Sc., LL.D.

PROF. PETTERSSON has, in conjunction with Prof. Nansen, completed a modification of his well-known apparatus for obtaining samples of sea-water without change of temperature. A specimen of the improved water-bottle constructed by Messrs. L. M. Ericsson & Co., of Stockholm and London, was exhibited in the museum arranged for the illustration of papers read to the British Association at the Bradford meeting. The purpose of this apparatus is to enclose a quantity of sea-water at any desired depth, to hold it securely, and to bring it to the surface without any change of temperature exceeding one-hundredth of a degree Centigrade. The previous form of insulating water-bottle was found by Dr. Nansen in his arctic expedition to be less trustworthy at great depths than in shallow water, hence the suggestions which resulted in the new apparatus.

The insulation, which is the essential feature of the water-bottle, is secured by a series of concentric chambers of non-conducting material, which are simultaneously filled with water, and so protect the portion, measuring about 2 litres, which occupies the large central tube. The cylindrical body is so constructed as not to become heated by compression at the greatest depth. This is effected by using metal, which is heated by compression, and indiarubber or ebonite, which is cooled by compression, in such proportions as to ensure constancy of temperature for the whole structure.

The water-bottle when set (see Fig. 1) is held apart so that the base, cylindrical body, and lid are separated, and the water passes freely through the concentric tubes, which occupy the cylindrical body, as the apparatus descends. When the apparatus is being drawn up, the propellor (which, during the descent, revolves freely) engages with a screw and releases the shackle supporting the lid. A heavy weight hung from the sides of the lid causes it to drop on to the top of the cylinder, which in turn is driven against the base, and the three parts of the water-bottle are locked rigidly together (see Fig. 2). On closing, the indiarubber discs which cover and project from the lower surface of the lid and the upper surface of the base-plate completely shut all the concentric tubes, and prevent any

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* Read at the British Association meeting at Bradford, September, 1900.

movement in the enclosed water. An arrangement is provided for the relief of pressure as the included water expands on being hauled up, the indiarubber ball

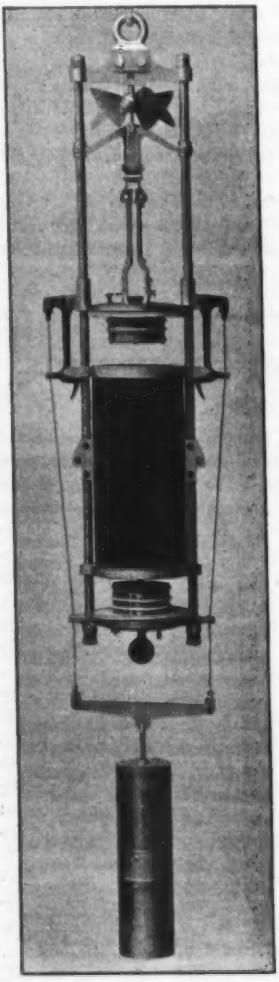

FIG. 1.—PETTERSSON-NANSEN WATER-BOTTLE DESCENDING, SET AND READY FOR USE.

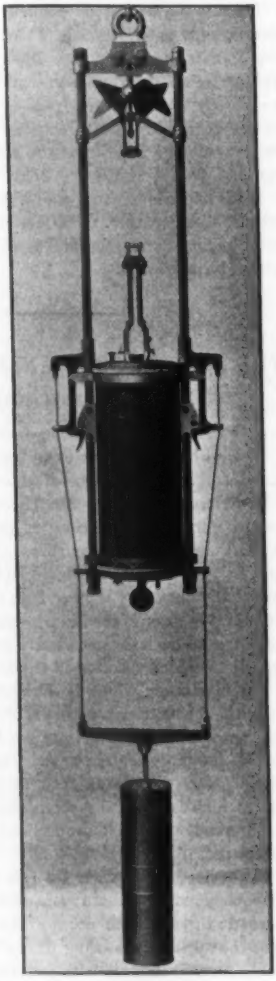

FIG. 2.—DITTO ASCENDING, CLOSED AND LOCKED.

seen in the photograph below the base-plate being in communication with the central tube. The propellor can be adjusted so as to release the catch after one, two, or more revolutions. After it has done so, it revolves freely. The temperature

is ascertained by a thermometer, protected against pressure (the metal case of which is alone shown in the figure), enclosed in the central tube, and projecting sufficiently far to be easily read. If preferred, the aperture for the thermometer may be closed (as shown) by a screw, and the thermometer inserted when the water-bottle is brought up. After the temperature has been observed, the water may be drawn off from the central tube by an ingenious stopcock, the lever of which works horizontally, so as to run no risk of being opened by pressure in moving through the water.

A reversing thermometer to give the temperature of the water independently may be attached to the upper part of the water-bottle by detaching the ring shown at the top of the instrument and bolting on a metal frame with a ring above. The thermometer is set in action at the moment of closing.

The whole apparatus weighs about 50 lbs., and is used on a wire line and worked by a steam-winch. Its framework consists of two solid brass rods parallel to one another, supporting the propellor frame above, the base-plate below, and the locking-blocks in the middle. The cylindrical body and the lid slide on these rods. The lower part of the weight, which serves both as a sinker and the actuator of the locking-gear, is made hollow and detachable, closed below by an indiarubber valve opening inwards, so that if it strikes the bottom it will enclose and bring up a sample of the sediment. However, it appears to me to be inexpedient to risk so heavy and delicate an instrument in such close proximity to the bottom, since at great depths it would almost certainly fall on its side and get clogged with mud before the running out of the line could be checked. It will probably be found better in practice to attach the deposit collector to the deep-sea sounding-lead.

During August, 1900, the improved water-bottle has been tested by Prof. Nansen on board the *Michael Sars* in the sea between Iceland and Spitsbergen, and at the greatest depth met with (3000 metres; 1670 fathoms) the insulation was perfect. On August 11 a sample was taken from 3000 metres, and when it came up the thermometer read −1°·285 C.; after 5 minutes, −1°·283; after 9 minutes, −1°·270; and after 11 minutes, −1°·210. On August 13, from 2000 metres (1110 fathoms), the thermometer showed −1°·135; after 5 minutes, −1°·135; after 6 minutes, −1°·130; and after 8 minutes, −1°·110. It is considered essential to use an included thermometer to secure exact results when working in polar waters, for which, indeed, the water-bottle was specially designed

Prof. Nansen has also experimented with an insulating water-bottle in which the insulating material consists, in addition to the concentric water-tubes, of a ring of eighty exhausted glass tubes, similar to the vessels used by Prof. Dewar in his experiments on liquid gases. Its insulation was proved to be perfect.

THE MONTHLY RECORD.

EUROPE.

Limnological Investigations on Lake Ladoga.—A note in the *Comptes Rendus* of the French Academy of Sciences (1900, No. 26) gives the results of investigations into the temperature of Lake Ladoga, carried out by Colonel J. de Shokalsky during the summers of 1897 and 1899. In both of these years the lake was visited during the first half of July, cruises being made in a small steamer, and the temperature of the lake-water taken at various depths, in 1897 at fourteen stations, and in 1899 at 20. A comparison of the results obtained on the two occasions is of considerable interest. In 1897 the distribution of temperature

through the different layers was *direct* throughout, though a great difference was observable between the figures obtained in the north and south of the lake, the water of the northern, deeper, part being colder, both at the surface and at fixed depths, than in the south. The warmest surface water (in the south) had a temperature of 55°·6 Fahr., and the coldest bottom water (in the north) one of 39° Fahr. These temperatures seemed relatively low for the time of year, but lower still were recorded in 1899, especially in the north. In the latter year the vertical distribution of temperature was found to be *inverse* at all the deep-water stations, the difference from the state of affairs in 1897 being attributable to the unusually low temperature which had prevailed throughout North-Western Russia during the spring and early summer. Although Ladoga certainly belongs to the category of temperate lakes according to M. Forel's classification, it would appear to come very near the border-line which separates such from polar lakes, in which the vertical distribution is always inverse. The maximum temperature-gradient occurred at a much lower level in 1899 than 1897, a fact, of course, due to the generally higher temperature of the water in the earlier year.

ASIA.

Dr. Sven Hedin's Latest Journeys.—Writing from Abdal, in the Lob Nor district, on June 27 last, Dr. Sven Hedin gives further details as to the programme of his journeys in Northern Tibet and neighbouring regions during the summer and autumn of the present year. At the time of writing, he was about to start for the Chamen Tagh, whither his caravan had already preceded him, his intention being to cross the Astyn Tagh and Koko-Shili ranges, so as to obtain a geological section of the country, and correct his route with that of his former Tibetan journey. After returning to his head-quarters in the Chamen Tagh, he hoped to make his way across Northern Tsaidam to Sachu, and thence west to the old bed of Lob Nor, continuing his investigations of the latter and of the ruins in its vicinity. Thence he proposed to carry a chain of altimetric observations to Kara-koshun and Chaklik, at which latter he hoped to arrive about January 1, 1901. It is announced that a report on Dr. Hedin's descent of the Yarkand river, and crossing of the Takla Makan, between Lob Nor and Cherchen, has been received from the traveller by the King of Sweden.

Marco Polo's Itinerary through Persia.—Captain P. M. Sykes writes from Persia, calling attention to an obscurity which attaches to the question of Marco Polo's outward journey through Asiatic Turkey and Persia, and on which Sir H. Yule seems to have been unable to throw light. That writer, in fact, appears to present two different views, without attempting to decide between them. On the map giving Marco's own geography (Yule's 'Polo,' 2nd edit., Introd., p. 107), the outward route is shown as passing through Armenia to Tabriz, and thence south-west to Kerman, whence it is drawn as turning north towards Khorasan. In the introduction, however (p. 19), it is supposed that, after passing through Ayaz and Sivaz, the route led by Mardin, Mosul, and Baghdad, to Hormuz; and it is shown in a similar way in the first section map of Marco's itinerary (vol. i. p. 1). Again, on p. 66, note 2, doubt is thrown on the idea of Marco travelling by Kisi (Kish, or Kishm), the mention of which follows the description of Baghdad. Captain Sykes's view is that Baghdad even was not visited by the traveller, but that from Ayaz he went to Tabriz, and thence by Sultanieh, Sava, Kum, Yezd, and Kerman, to Hormuz. Thence, finding boats unseaworthy, or for other reasons, he returned by Sirjan to Kerman, and thence to Khorasan. Yule's map, above referred to (Introd., p. 107), shows the outward route from Tabriz to Kerman as an imaginary straight line, missing Yezd, which was passed through on the return journey. Captain

Sykes, however, considers that from the indications of the text, both the outward and return journeys followed the same route between Tabriz and Kerman.

Proposed Map of India on the Scale of 1 : 1,000,000.—The Survey of India Department has determined to supply a long-felt want by the preparation of a general map of India and neighbouring countries on the scale of 1 : 1,000,000, being the scale adopted for the map of the world advocated by the International Geographical Congress. In a recently issued pamphlet (Professional Paper, No. 1), Colonel Gore, the present Surveyor-General, discusses the question of the projection to be adopted, the size and shape of the sheets, and other similar points. In spite of the advantages arising from the projection of each sheet on its own central meridian, this is open to the fatal objection that it is impossible to join the sheets together to make one large map. It has therefore been decided that there must be one projection for the whole map, some form of conical projection being used; and to avoid as far as possible distortion of scale, a secant conical projection has been chosen, the intersections being made in the parallels of 16° and 32°. The longitudes will be referable to the Greenwich meridian, taking that of Madras Observatory as 80° 14′ 47″, the most recently determined value. The bounding lines of each sheet are parallels and meridians, the side margins being thus straight but slightly converging lines, while the top and bottom margins are concentric circles. The map will embrace the whole area from the west of Persia to the east of Burma (44° to 104° E. long.), and from Ceylon to the Oxus (4° to 40° N. lat.); the whole of Tibet, with parts of Turkistan and Western China, being thus included. The total number of sheets (excluding those occupied wholly by sea) will be 106, each embracing 4° of latitude and 4° of longitude. Those relating to India proper will be engraved, the rest photozincographed, at least in the first instance. A table of co-ordinates for plotting the graticules of the sheets is given with the paper.

Results of the Pavie Mission in Indo-China.*—A series of publications, which promises to be of great value for the geography of French Indo-China, is in course of preparation in Paris. It deals with the results of the well-known mission, which, under the chief direction of M. Auguste Pavie, executed the first accurate surveys of large portions of Laos and Annam between 1879 and 1895. The two volumes first published, from the pen of M. Pavie himself, belong to the section "Études diverses," and treat of the literature and history of Cambodia, Laos, and Siam. Of the geographical section, which will comprise in all some five or six volumes, the third volume alone appears to have been yet issued, though M. Pavie's introduction on the general geographical results of the mission was already, early this year, in an advanced stage. The volume now under review is by Captain Cupet, on whom, among the forty Europeans from first to last attached to M. Pavie's staff, the largest share of the topographical and geographical labours devolved. Captain Cupet describes in turn the various expeditions carried out by him in the course of his surveys, adding some useful general observations on the geography and ethnology of Laos and neighbouring countries. The results of the surveys are shown on fifteen sheets, on the uniform scale of 1 : 500,000, which supply a valuable groundwork for the mapping of a large part of French Indo-China. Captain Cupet's earliest and most extensive work lay in the upper Laos country, on the left bank of the Mekong, from the Black river to the latitude of Vinh. In his general sketch of this region, the author dwells on the influence of the river systems on the political history of the country, each great basin forming a political unit, while the streams, although tortuous, constitute almost the only means of

* Mission Pavie, Indo-Chine, 1879–1895. 'Géographie et Voyages,' iii.: "Voyages au Laos," etc. Par le Capitaine Cupet. Paris: Leroux. 1900.

communication amidst the mass of mountains with which the country is filled. The orographic centre of the region is the *massif* of Pu-loi, with an altitude of some 6500 feet, which gives rise to the Song-ka, the Nam Suong, and the Nam Het. Captain Cupet's later explorations were concerned with the country inhabited by various wild tribes on the frontiers of Annam and Cambodia, and his volume contains much information respecting these. He divides the aborigines of Indo-China into three broad groups, the first constituting a central core between the territories of the Annamites, Cambodians, and Thais; the second, somewhat more civilized, occupying an outer zone, especially towards the north and west; and the third scattered over the mountains in the midst of the more advanced populations. The political importance of these races, which form a barrier between Annam and the Mekong valley, must, he says, be evident to all, and, unless definitely occupied, their country is likely to be the focus of future disturbances.

The Bay of Balik Papan, East Borneo.—Mr. Henry Richards, a surveyor in the employment of the mercantile firm of M. S. Samuel & Co., sends us an account of the Bay of Balik Papan, a small but excellent harbour on the coast of Dutch East Borneo. As is well known, the east coast of Borneo is, as a rule, low and swampy, with few natural havens, the only trading posts of any importance in the Kutei Residency being situated inland on the Kutei or Mahakkam river. The bay of Balik Papan occurs in 1° 15′ 55″ S., almost immediately below the delta of that river, at a point where the coast-line is higher and more abrupt than elsewhere. It is well sheltered from the swell of the Straits of Macassar, and has deep water, affording safe anchorage to vessels during both monsoons. In 1897, Messrs. Samuel & Co. obtained a concession from the Dutch Government for the working of coal and petroleum, and since they commenced operations the channels have been carefully surveyed and buoyed by the authorities, so that vessels drawing 24 feet can approach the wharf at all states of the tide. The place seems, until recently, to have entirely escaped notice, the population, now 2000, having been *nil* before 1897. Off the point of Pulo Tokong there is a small island formed of sandstone boulders, surrounded by very deep water. It is frequented by Argus and fire-backed pheasants. The name Balik Papan is said to signify "the return of planks," from a legend telling of the miraculous return to a Malay settler of the planks which formed his yearly tribute to the Sultan at Kutei. His grave, supposed to be on the island above mentioned, is now held sacred by the natives.

AFRICA.

Surveys in British South Africa.—The recently issued report of the astronomer at the Cape contains a statement of the progress made with the geodetic survey of South Africa down to the end of last year. In connection with the decision to carry the railway due north from Gwelo, it was resolved to continue the work on new lines, the triangulation being pushed rapidly forward in the same direction. By this means valuable aid towards the accuracy of the railway and other surveys was afforded, while the measurement of the proposed geodetic arc along the 30th meridian was also furthered. Before the end of July twenty-four stations had been occupied, and the angles of the triangles in the arc measured as far north as 18° 35′ S. The reconnaissance and beaconing of fourteen additional stations carried the arc to Nyamanje (16° 30′ S., 30° 45′ E.), within 60 miles of the Zambezi, but the work was then stopped by the smoke from grass-fires. The operations for the demarcation of the Anglo-German boundary have been rendered very tedious and indirect, it being found impossible to carry triangles from Rietfontein northwards, owing to the flat and waterless character of the country traversed by the 20th meridian. It was hoped that the field work of the triangulation would

be finished by August of the present year, the actual demarcation being reserved for the following December, the month in which the water-melons are in fruit.

Mr. Weatherley on Lake Mweru.—Mr. Poulett Weatherley writes from Chita, on Lake Mweru (8° 45′ 47″ S.), giving some details of various observations made by him on the lake-shores. He has not yet completed a map of the lake, but hopes to do so eventually, the conspicuous landmarks which exist on either coast affording great facilities for a compass survey, such as are entirely absent on the swampy margins of Bangweulu. From bearings already taken, Mr. Weatherley is inclined to think that in maps which have been published due allowance has not been made for compass variation, which is said to be 12° W. at the present time. If this is so, the result would of course be that the axis of the lake would be still further removed from the direction of the meridian than is generally shown, and this is borne out by Mr. Weatherley's statement, that from Chipamba, on the east coast, the true north is about in the direction of Mpweto's, while from Mount Pirie, on the west coast (8° 50′ 40″ S.), true south is about in the direction of the Chimbofuma inlet. Other bearings determined by Mr. Weatherley are as follows:—

Point of observation.	Latitude.	Object observed.	Magnetic bearing.	True bearing.
	° ′ ″		°	°
Chienje ...	8 28 30 S.	Kasengeneke bluff *	319	307
Kasengeneke	8 28 32 S.	Kalungwizi delta	179	167
Chita	8 45 47 S.	,, ,,	153	141

The opposite shores are distinctly visible, the one from the other, so that innumerable cross-bearings may be taken. On the west side the principal landmarks are: (1) Mount Kampingi, on the north side of the Lualaba exit, in the centre of the curve made by that river. (2) Mounts Bolibwe and Pirie, table mountains only about three-quarters of a mile apart, and standing somewhat out from the escarpment of the Bukongolo plateau, in about 8° 50′ 40″ S.; from Pirie the whole lake, with the exception of the extreme north-west corner, is visible. Its height above sea-level is 4158 feet, and above the lake 958 feet. (3) Mount Ngongwe, or Gnongwe, an isolated peak some 6 miles from the shore, in 2° 5′ 3″ S. On the shores of Bangweulu few points reach more than 40 feet above the surrounding marsh and water. The most pronounced are Silosi and Changilo, which may possibly be 80 to 100 feet high. Mr. Weatherley seems still not quite satisfied with his work on Bangweulu and the Luapula, but is doubtful of being able to return to put the finishing touches to it. He has sent us some excellent photographs of Bangweulu, Mweru, and the Luapula.

The British Central Africa Protectorate.—Mr. Alfred Sharpe's report on the British Central Africa Protectorate for 1899 records a satisfactory increase in trade and revenue, the value of exports having doubled, while that of imports has increased by 50 per cent. The year was very favourable for the coffee crop, and the export of the produce rose, as compared with the preceding year, from 23,000 odd lbs. to 62,000. Tobacco and chillies have also been grown with success, while the cultivation of rice on the shores of Lake Nyasa promises good results. Various new roads have been opened, but the great need of the country is a railway from Chiromo to Blantyre, to be eventually extended to Nyasa. Transport requirements have so largely increased, that almost the whole labour-supply is

* On south side of Lualaba exit.

occupied in carrying loads, leaving little available for planting and other operations. Mr. Sharpe thinks that in the current year the whole labour-supply will hardly cope with the transport question, and that, unless a railway is built, the Protectorate has almost reached its limit of production and export. Navigation on the Shire has been comparatively easy, the level of Nyasa having been higher than at any time since 1896. The Admiralty are bringing out a chart of the lake, based on the work of Lieut. Rhoades, who is at present engaged in obtaining systematic sets of soundings. In connection with the definition of the Anglo-Portuguese boundary, both in the east and west of the Protectorate, the survey office assisted in the mapping of 8000 square miles of country, the lower portion of the western side alone remaining to be defined. The European population has slightly increased, while Indian traders, whose operations are probably of service to wholesale dealers, have settled during the year at various stations. The report includes observations by Dr. Gray on the health of the Protectorate. Malarial fever, though causing much inconvenience, is not a deadly disease in Nyasaland. Hæmoglobinuric fever continues to resist efforts to cope with it, though the mortality rate has somewhat lessened under improved treatment. Dr. Gray points to the fact that the best health is enjoyed by the administration officials, as indicating that indoor employment, coupled with moderate exercise in the evenings, is the most suitable for a European in British Central Africa.

French Explorations in the Sobat Basin.—A detailed account of the geographical work carried out in the Sobat basin by the several members of the Bonchamps mission has at last been published in *La Géographie* (July, 1900). In addition to the journey of M. Bonchamps himself in 1897, others of some importance were made in the following year by MM. Faivre and Potter, who made their way to the White Nile by way of the Ajubba, or Pibor, reaching *en route* a point as far south as 6°. The collected itineraries of the mission are shown by M. Michel, one of its members, on a general map on the scale of 1 : 3,000,000, while, as already mentioned in the *Journal*, a special map in 14 sheets on the large scale of 1 : 200,000 has also been prepared by him. M. Michel gives a geographical sketch of the country traversed, paying special attention to the various upper branches of the Sobat. He divides the Abyssinian plateau, between the Hawash valley on the east and the plain of the White Nile on the west, into three zones. The first consists of wide treeless plains varying between 6500 and 8500 feet, covered in places with limestone strata, in which the few streams have cut themselves deep beds. The second zone is formed by a mountainous region about the sources of the Hawash and Omo, extending west to the valley of the Didessa. The chains rise to a height of nearly 10,000 feet, and are separated by deep valleys. Their upper parts are clothed with low forest, and the lower slopes with scrub, partially cleared for cultivation. The third zone, traversed for the first time by the French mission, resembles a sea of low hills of an even height (5000 to 5500 feet above the sea), which leaves not a mile of level ground between them. It is marvellously well watered by streams flowing to the Sobat, and produces coffee and honey in abundance. The most important river is the Baro, which has numerous tributaries, and is likely to prove of more economic value than the southern branch of the Sobat, which has a smaller volume. M. Michel gives detailed statistics of the Baro, Birbir, Didessa, and Ajubba (Pibor), stating their depth, current, etc., at different seasons. It is somewhat difficult to fit together the results of the French explorations with those of Captain Wellby. M. Michel makes the Ajubba and Ajuaru, which seem to represent the two Ruzis of Captain Wellby, take their rise in about 6° N. from the margin of a high plateau to the south; whereas, according to the English traveller, their valley continues at a

comparatively low altitude some two degrees further in that direction, only reaching a height of 2000 feet in about 4° N.

Economic Geography of the French Sudan.—The July number of *La Géographie* contains a paper by M. Baillaud on the economic value of the French Niger territory, accompanied by a map, in which the principal facts connected with the commercial geography of that region are shown in a striking and somewhat novel way. The commercial importance of the various centres is shown by circles, of which the size is proportional to the total trade carried on by each. The principal trade routes are also shown by bands of colour, of which the breadth is proportional to the volume of trade passing along them, while the colour denotes the race by which it is carried on. The map brings out in a striking way the barrier to commerce which has been formed by the forest zone along the shores of the Gulf of Guinea, almost all the more important centres (with the exception, before its destruction by Samory in 1897, of Kong) lying in the upper Niger and Senegal basins, and carrying on their commercial intercourse with the north and west. Compared with the routes from St. Louis to Kayes and Medina, and from the north across the Sahara to Timbuktu and Nioro, all other channels of communication with the outside world show, according to M. Baillaud's map, an exceedingly slight commercial movement. The external trade with the north is of course carried on by Moorish caravans, while the internal routes are frequented principally by small traders (Diulas) of the Mandingo race in the west, and of that of Mossi in the east. M. Baillaud divides the country into zones, according to the chief characters of its agriculture and vegetation, showing also the limits of the growth of the principal economic products—rubber, kola-nuts, karite, etc. In regard to the present lines of commerce, he shows how the importance of Timbuktu as the distributing centre for the Sudan has diminished since the opening of the route from Medina *viâ* Nioro, and the consequent falling off of the Saharan trade. It is, however, still the greatest market for salt in the whole of Africa, and this will probably secure a continuance of its prosperity. M. Baillaud, whose voyage down the Middle Niger has already been referred to in the *Journal*, entertains sanguine views as to the use of the river as a means of communication, and considers it possible that French goods may find a market in the Hausa states of the Central Sudan by this route. The Hausa merchants already have dealings with the eastern borders of the French Sudan, especially at Sansan Hausa, which has lately taken the place of Say as a trade centre.

AMERICA.

Proposed Improvement of the South-west Pass of the Mississippi.—The need for additional facilities for entering the mouth of the Mississippi by large vessels has lately led to the discussion of projects for the opening of the south-west pass by means of breakwaters. Two reports have already been made to Congress by boards of engineers, the measures suggested being in the one case the construction of two parallel jetties, in the other that of bottle-shaped jetties, on either side of the stream. No definite conclusion has, however, been yet arrived at, and meanwhile a fresh scheme has been put forward by Mr. Lewis M. Haupt, who, in the July number of the *Journal of the Franklin Institute*, describes a method by which he thinks the natural energy of the stream may be utilized for the opening of a channel by the construction of a single curved jetty, so placed as to produce a reaction and scour across the entire bar, and effect a lateral displacement of silt to the opposite bank of the channel. The writer lays stress on the concentration of energy obtained by the concave curvature of a river-bank, which, as is well known, always results in a deepening of the channel in its vicinity. Of the 175,000 square feet, representing the present area of discharge along the bar

crest, he proposes to cut off 115,000 square feet, or 66 per cent. The threefold discharge thus produced over the remaining third of the river section would, in the first instance, cause an increase of velocity, and, in the second, the gradual enlargement of the section as its consequence, these results following the progress of the work, so that the improvement would be rapid in proportion to the rapidity of construction of the jetty. This would start from East Point and have a length of about 4 miles, during the second half of which it would curve gently to the west. Mr. Haupt holds that a normal section would thus be produced with resulting mean depths of over 40 feet, such as are found at present in the inner portion of the pass. The advance of the bar seawards, which during the interval between 1838 and 1898 was at an average rate of 259 feet per annum, and which would be increased by the adoption of parallel jetties, would, he thinks, be immaterial on the plan described.

Dr. Sapper's Volcanic Studies in Central America.—In the seventh number of *Petermanns Mitteilungen*, Dr. Sapper gives an account of his examination, in 1897, of various volcanoes of Guatemala and Salvador, by which he has been able to make some additions and corrections to the work of von Seebach, Dollfus, and Montserrat, some thirty years previously. The most important of the volcanoes examined were those of Pacaya, Suchitan, and San Miguel, the first of which (8415 feet) presents one of the most complicated structures of all the Central American volcanoes. Dr. Sapper was unable to clearly make out its history, but is inclined to think that the great elliptical crater of Calderas, now in part occupied by the small lake of that name, was the primitive crater of the volcano, and that the eruptive forces subsequently shifted their activity to the south, in which direction the cone now active is placed. Suchitan has a large rock-crater, breached to the north-north-east, the interior of which is almost entirely covered with forest. Subsidiary cones and a second large crater occur round the flanks of the central crater. The volcano of San Miguel, which possesses both an inner and an outer ring-shaped crater, both of nearly circular outline, is of interest from the changes which have evidently taken place since the survey made by Dollfus and Montserrat in 1866. Dr. Sapper calls attention to the regularity with which the principal volcanoes are arranged in lines, which points to their formation along rifts in the Earth's crust. In South-Eastern Guatemala, on the other hand, a number of important volcanoes occur with no such regular arrangement, so that we must conclude either that these occupy positions on short, independent rifts, or that they are located singly on points of least resistance of the crust to the internal forces. The lesser volcanoes are for the most part subsidiary to those of the first rank, but some are so far removed from these as to be justly regarded as independent manifestations of volcanic activity. Their position cannot be assigned to definite rift-lines, but in certain regions a large number seem to be collected into belts. Dr. Sapper has, by his investigations, doubled the number of known volcanoes in the districts visited, but much remains to be done before our knowledge can be in any way complete.

A Century of Exploration in South America.—Prof. Sievers has done good service in summarizing, in the sixth number of *Petermanns Mitteilungen* for the present year, the history of South American exploration during the nineteenth century. The course of discovery in that continent has followed very different lines from that in other quarters of the globe, and its details are, perhaps, on the whole less generally known for that very reason. Although the broad outlines of South American geography had been made known before the middle of the sixteenth century, detailed exploration, which met with little encouragement from the Spanish and Portuguese authorities, has since proceeded with great slowness, and,

from many points of view, less is still known of large portions of the surface than the greater part of Central Africa. Prof. Sievers begins by sketching the state of knowledge in 1799, the year when Humboldt first landed on the shores of the continent; next dealing with the work of that traveller, which may be considered to usher in a new era in the history of the subject. With regard to the subsequent course of discovery, he points out the difficulty of laying down sharply defined periods, characterized by activity in one field or another. The work of exploration has been mainly carried on by private enterprise, and its scene has shifted from one quarter to another with great irregularity. A certain distinction may, however, be drawn between the Andes lands on the one hand and Brazil on the other, while during the latter half of the century the southern portion of the continent has formed a third theatre of exploring activity. The first half of the century the writer regards as the period of great journeys, or those extending over large portions of the continent, while since 1850 the work has been more detailed and systematic, especially in the south. A series of ten maps shows the state of knowledge at as many separate periods, the known portions being divided into three categories according to the degree of knowledge possessed about them. The last of the maps brings out in a surprising way the large areas about which no accurate knowledge exists, and the extent to which surveys have been confined, apart from particular countries, such as Argentina, to the courses of streams. At a distance from these the whole central core of the continent, occupying the greater part of the Amazon basin, appears as absolutely unknown.

Journey from Chesterfield Inlet to Great Slave Lake.—In Mr. Hanbury's paper, vol. xvi. p. 77, the first three minimum temperatures should be −11°, −13°, −1°.

AUSTRALASIA AND PACIFIC ISLANDS.

Quiros and the Discovery of Australia.—A question bearing on the discovery of Australia has lately aroused some interest in that country, and was the subject of discussion at a recent meeting of the Royal Geographical Society of Australasia (Victorian branch). In his 'History of the Catholic Church in Australia,' Cardinal Moran, known as a scholarly writer, started the theory that the land reached in 1606 by the navigator Quiros, instead of being, as has always hitherto been supposed, the island of Santo, in the New Hebrides, was in reality Queensland, and that the harbour of St. Philip and St. James is to be found in Port Curtis, on which the township of Gladstone now stands. Cardinal Moran's view naturally found many critics, to whom he has replied in various letters to the Australian press. At the meeting alluded to, the orthodox view was vigorously championed by Messrs. Theodore Bevan and Macdonald, though the new theory met with support from the chairman, Mr. Panton. Cardinal Moran's arguments are far from convincing. They rest upon certain relics and traditions current at Port Curtis (*e.g.* the discovery there of an old brass cannon bearing the inscription "Santa Barbara, 1596"), and on various points in the narrative of Quiros, which the cardinal holds to apply better to Australia than to the New Hebrides. The theory, therefore, has the disadvantage of resting on the descriptions of a somewhat visionary enthusiast, endeavouring to arouse an interest at home in his discoveries. The points chiefly relied upon in its support are the abundance of animals spoken of, the cordilleras of very lofty mountains in the interior of the country, the size of the rivers mentioned, the supposed existence of marble quarries, and the "warbling at dawn" of the birds. The opponents of the cardinal called attention to a number of facts which cannot be harmonized with the supposition that Port Curtis was reached by Quiros, especially the entire disagreement of the latitude mentioned

both by Quircs and Torres with that of Port Curtis, the position of the land discovered relatively to other known islands of the Pacific, the use by the inhabitants of bows and arrows, and the general luxuriance of the country as described by Quiros. To these might be added the impossibility of reconciling the subsequent course of Torres (south-west and north-north-west) on the way to New Guinea with the position of Port Curtis, and the statement of Don Diego de Prado (an enemy, it is true, of Quiros) that the lands discovered by that navigator were merely "rocks and small islands."* Cardinal Moran and his supporters lay stress on the mention of pigs on "Austrialia del Espiritu Santo," saying that there is no evidence that those animals existed on Santo before the arrival of Europeans. To this it may be replied that pigs were found by Tasman in the still more easterly Tonga group, on its discovery by him in 1643.

POLAR REGIONS.

The Duke of the Abruzzi's Expedition.—The *Stella Polare*, with the members of the Duke of the Abruzzi's Arctic Expedition on board, arrived at Tromsö on September 5, after an absence in the far north of nearly fifteen months. The duke's party has achieved the distinction of beating all former records in respect of the highest latitude reached, which exceeded that of Nansen's furthest by 19′ (86° 33′, as compared with 86° 14′). From the accounts which have so far been made public, it appears that after reaching Cape Flora towards the end of June, 1899, the *Stella Polare* was able to force a passage up the British channel, one of the main openings amidst the Franz Josef Land archipelago, passing near Nansen's winter hut (81° 14′ N.), and reaching Teplitz bay on Crown Prince Rudolf Land, almost the furthest point attained by the sledge-party of the Austro-Hungarian Expedition in 1874, on August 9. Here, in 81° 53′ N., it was determined to winter, and steps were at once taken for the erection of an observatory and other quarters. On September 8, during unusually heavy ice-pressure, the ship was driven on shore, considerably damaged and leaking badly. A large tent was therefore erected, and in this the members of the expedition spent most of the winter, trial sledge expeditions being, however, undertaken from time to time. During one of these the duke had his fingers badly frost-bitten, and was unable to take an active part in the further work of the expedition. The leadership of the sledge-party for the north therefore devolved on Captain Cagni. About the new year the cold became more intense, but the weather being as a rule calm, it was not so severely felt as it would otherwise have been. On March 11 Captain Cagni set out his northward journey with twelve companions, a course being first steered for the supposed Petermann Land, which, however, proved to have no existence. Owing to the impossibility of forming depôts of provisions for the return journey, the whole supply had to be taken with the party; but in order to economize it as much as possible, three detachments of three men each were sent back at intervals of ten days, leaving Captain Cagni to continue the route with three men. The second return party, consisting of Lieut. Quirini, the Norwegian machinist Henrik Stokken, and one other, never reached their destination, and all search for traces of the party proved fruitless. During the northward march, the route of which lay considerably to the west of that of Nansen and Johannsen, the ice was at first extremely difficult, but afterwards became better, and had not provisions failed it would have been quite possible to have pushed still further north. As it was, Captain Cagni and his companions lived for the last fifteen days on dog-flesh, reaching Teplitz bay with only two sledges and six dogs. The journey had taken

* 'De Morga's Philippines' (Hakluyt Society's edition), p. 412.

one hundred and four days, the return being lengthened by the drift of the ice, which took the explorers to Erasmus Ommanney island, some distance south of Teplitz bay. The icy wilderness which had been traversed had been found entirely devoid of life. The *Stella Polare* was got clear of the ice on August 8, but after a quick passage down the British channel was again caught and imprisoned for a fortnight. The principal results of the expedition are the proof that no land exists to the north and north-west of Franz Josef Land, and the survey of the northern portion of the latter. On reaching Christiania on September 11, a hearty reception was given to the explorers, who were met by representatives of King Oscar and of the Norwegian Geographical Society, and among others by Sir Clements Markham, who was then staying in Norway. In the evening a torchlight meeting was held, at which Dr. Nansen made a complimentary speech. On September 14 the Duke reached Turin, where he received an enthusiastic welcome.

Another Andrée Buoy discovered.—The discovery of another buoy belonging to Andrée's expedition was announced from Skjervö, Norway (lat. 70° N.), on August 31. According to the communication enclosed within it, the buoy (No. 4 of the series) was thrown out at 10 p.m. on July 11. The balloon was, at the time of writing, at an altitude of 250 metres (820 feet), and the direction N. 10° E. A postscript states that this had changed to N. 45° E., and that the balloon was over very rugged ice, the weather continuing splendid. Four carrier pigeons had been despatched, and were flying west. This does not add much to our knowledge of the course of the voyage, as the date of the communication is still that of the day on which the ascent was made. The buoy No. 3, which had been found in July off the west coast of Iceland, proved, on examination, to be empty.

Lieut. Amdrup's Expedition to East Greenland.—Telegraphic intelligence has been received in Copenhagen to the effect that the *Antarctic*, with a portion of Lieut. Amdrup's party on board, reached Iceland on September 5, the expedition having met with considerable success. A landing was effected by Lieut. Amdrup at Cape Dalton, in 69° 25′ N., on July 19, the explorer's intention being to complete the map of the coast from that point to 67° 20′, where his work ceased last year, by a boat journey towards Angmagsalik. The rest of the expedition, under Dr. Hartz, explored and mapped the country northwards as far as Scoresby sound. The ice-conditions towards the south were favourable, and the party on board the *Antarctic* was able also to map the unknown region south of King Oscar fjord.

OBITUARY.

Dr. John Anderson, F.R.S.

Dr. John Anderson, whose death, at the age of sixty-six, occurred at Buxton about the middle of August, was best known to geographers for the part he took in the early exploring expeditions on the Burmo-Chinese frontier, while Burma was still an independent state. Dr. Anderson was born at Edinburgh in 1833, being the son of the late Mr. Thomas Anderson, secretary to the National Bank of Scotland; and was educated in that city, finally taking the degree of M.D. at Edinburgh University in 1861. After holding, for a year or two, the post of Professor of Natural History in the Edinburgh Free Church College, he received in 1865 from the Government of India the appointment of curator (subsequently changed to that of superintendent) of the newly founded Indian Museum at Calcutta, whither he had proceeded in 1864. A few years later he became, in addition,

Professor of Comparative Anatomy in the Medical College, Calcutta, and in 1868 he was chosen to accompany the expedition then proceeding under Major (afterwards Sir Edward) Sladen through Burma to China. At that time our knowledge of the upper course of the Irawadi was still most imperfect, and the work of the expedition, which for the first time ascended the river in a steamer to Bhamo, may be said to have begun on leaving the capital. The subsequent land-route led from Bhamo up the valley of the Tapeng, through a country inhabited by wild frontier tribes, to Momien, in Western Yunnan. A large amount of valuable information was collected, and afterwards embodied in Dr. Anderson's official report, which, in addition to the narrative of the journey, dealt in an exhaustive way with the history, ethnology, geography, trade-routes, etc., of the districts traversed. A second, and equally voluminous work, dealt with the natural history, the author's own special department. In 1874 Dr. Anderson again reached the frontiers of China with the expedition of Colonel Horace Browne, which met Mr. Margary on the completion of his arduous journey through China to Burma. As is well known, the expedition, after the murder of Mr. Margary, was forced to retire without fully attaining its objects. A narrative of the two expeditions was published by Dr. Anderson under the title 'Mandalay to Momien.'

In 1881 Dr. Anderson carried out, on behalf of the trustees of the India Museum, an investigation of the marine zoology of the Mergui archipelago, the results being afterwards published by the Linnæan Society. After his retirement in 1887, he devoted himself to zoological researches, especially on the fauna of Egypt, and it was to his zealous advocacy that the recent action of the Egyptian Government in instituting a fresh survey of the Nile was due. In connection with his visit to Mergui, he had paid much attention to the history of English trading relations with Siam, on which he brought out an interesting volume in 1890. He had been a fellow of our Society since 1885, but in 1870 had contributed a paper to our *Journal* (vol. xl.) on the sources of the Irawadi.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., LL.D., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.	Mag. = Magazine.
Abh. = Abhandlungen.	Mem. = Memoirs, Mémoires.
Ann. = Annals, Annales, Annalen.	Met. = Meteorological.
B. = Bulletin, Bollettino, Boletim.	P. = Proceedings.
Com. = Commerce.	R. = Royal.
C. Rd. = Comptes Rendus.	Rev. = Review, Revue.
Erdk. = Erdkunde.	S. = Society, Société, Selskab.
G. = Geography, Geographie, Geografia.	Sitzb. = Sitzungsbericht.
Ges. = Gesellschaft.	T. = Transactions.
I. = Institute, Institution.	V. = Verein.
Iz. = Izvestiya.	Verh. = Verhandlungen.
J. = Journal.	W. = Wissenschaft, and compounds.
k. u. k. = kaiserlich und königlich.	Z. = Zeitschrift.
M. = Mitteilungen.	Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alpine Tunnels. *Nature* **62** (1900): 281-284. **Fox.**

The Great Alpine Tunnels. By Francis Fox. *With Plans and Sections.*

Alps. **Yeld.**

Scrambles in the Eastern Graians, 1878–1897. By George Yeld. London: T. Fisher Unwin, 1900. Size 8¼ × 6, pp. xx. and 280. *Map and Illustrations. Price 7s. 6d. Presented by the Publisher.*

A collection of summer excursions amongst the Graian Alps, illustrated by numerous photographs, by Dr. Tempest Anderson, which are very finely reproduced.

Alps—Glaciers. *Mem. S.G. Italiana* **9** (1899): 143–177. **Marson.**

Sui ghiacciai italiani del gruppo del Pizzo Bernina. Osservazioni del 1898 con l'aggiunta dei risultati di una rapida escursione ai principali ghiacciai svizzeri dello stesso gruppo. Nota del prof. Luigi Marson. *With Maps and Illustrations.*

Alps—Simplon Tunnel. *P.I. Civil Engineers* **140** (1900): 249–266. **Fox.**

The Construction of the Simplon Tunnel. By C. B. Fox. *With Plans and Sections.*

Austria—Bosnia and Herzegovina. *Deutsche G. Blätter* **23** (1900): 97–108. **Bräss.**

Reisebilder aus Bosnien und der Hercegovina. Von Dr. Martin Bräss.

Austria—Tirol. *Globus* **78** (1900): 62–63. **Jäger.**

Steinach am Brenner. Von Julius Jäger.

Austria-Hungary—Glaciers. *Abh. k.k. G. Ges. Wien* **2** (1900): 91–119. **Böhm.**

Die alten Gletscher der Mur und Mürz. Von Dr. August Böhm Edlen von Böhmersheim.

Austria-Hungary—Limnology. *Abh. k.k. G. Ges. Wien* **2** (1900): 121–127. **Penck.**

Bemerkungen über alte und neue Lothungen im Hallstätter See. Von Dr. Albrecht Penck. *Also separate copy. Presented by the Author.*

Austria-Hungary—Surveys. *M. Militär-G.I.* **19** (1899): 166–216. **Lehrl.**

Das Präcisions-Nivellement in der österreichisch-ungarischen Monarchie. Von Franz Lehrl. *With Map.*

Die Fortsetzung des Präcisions-Nivellements, ausgeführt in Jahre 1899.

This describes the methods of levelling, the different kinds of benchmarks, and the work done in 1899 in the levelling of Austria-Hungary.

Austria-Hungary—Surveys. *M. Militär-G.I.* **19** (1899): 145–165. **Netuschill.**

Die astronomischen Gradmessungsarbeiten des k. u. k. militär-geographischen Institutes. Von Franz Netuschill.

Balkan Peninsula. *Ann. G.* **9** (1900): 359–372. **Cvijić.**

La période glaciaire dans la péninsule des Balkans. Par M. J. Cvijić. *With Maps.*

Summarizes the author's conclusions respecting the former glaciation of the Balkan peninsula.

Balkan—Peninsula. *Abh. G. Ges. Wien* **2** (1900): 1–93. **Cvijić.**

Morphologische und glaciale Studien aus Bosnien, der Hercegovina und Montenegro. I. Theil: Das Hochgebirge und die Cañonthäler. Von Dr. Jovan Cvijić. *With Maps.*

A valuable study of the physical history of a portion of the Balkan peninsula, based on the author's personal observations.

Central Italy. **Jeaffreson.**

A Handbook for Travellers in Central Italy, including Tuscany, the Tuscan Islands, Umbria, the Marches, and part of the late Patrimony of St. Peter. Twelfth Edition. Rewritten by the Rev. Herbert H. Jeaffreson, M.A. London: John Murray, 1900. Size 7 × 4½, pp. xxxvi. and 314. *Maps and Plans. Price 9s. Presented by the Publisher.*

This new edition of Central Italy appeals, like all the handbooks of this series, to the cultured traveller, and while treating fully of the artistic treasures of Florence and the other cities of the central belt, it is finely equipped with good maps and practical hints to tourists.

Europe—Geodesy. **Weiss and Schram.**

Publicationen für die Internationale Erdmessung. Astronomische Arbeiten des k.k. Gradmessungs-Bureau ausgeführt unter der Leitung des Hofrathes Theodor

v. Oppolzer. Nach dessen Tode herausgegeben von Prof. Dr. Edmund Weiss und Dr. Robert Schram. XI. Band. Längenbestimmungen. Wien: F. Tempsky, 1899. Size 12½ × 10, pp. x. and 274. *Presented by the K.K. Gradmessungs-Bureau, in Wien.*

Europe—Historical. *Aarb. Nord. Oldk. Historie* **15** (1900): 16–50. **Fabricius.**
Korstoge fra Norden til den spanske Halvø. Af A. Fabricius.

On early journeys from the Scandinavian to the Iberian peninsula.

Europe—National Surveys. *M. Militär-G.I.* **19** (1899): 257–282. **Haardt.**
Notizen über die organisation der militär-topographischen Arbeiten in den europäischen Staaten. Von Vincenz Haardt von Harteathurn.

France. *B.S. Belge Géologie* **13** (1899): 85–206. ———
Compte rendu détaillé des excursions de la Session Extraordinaire Annuelle de la Société belge de Géologie, de Paléontologie et d'Hydrologie tenue du 15 au 21 août 1898 à Nancy et dans les Vosges. *With Map and Plates.*

France—Colonization. **Zimmermann.**
Questions Dipl. et Colon. **9** (1900): 705–719; **10** (1900): 1–21.
Lyon et la Colonization française. Par M. le Prof. M. Zimmermann.

France—Ethnology. *Le Globe, B.S.G. Genève* **39** (1900): 95–107. **Pittard**
Note préliminaire sur l'ethnologie de la Savoie et de Haute-Savoie. Par M. le Dr. Eugène Pittard.

France—Paris. *Ann. G.* **9** (1900): 340–358. **Dupuy.**
Le sol et la croissance de Paris. Par M. Paul Dupuy. *With Maps.*

Shows the influence on the expansion of Paris of the relief of the soil as determined by the waters of the Quaternary period.

France—Speleology. *C. Rd.* **131** (1900): 130–132. **Martel.**
Sur de nouvelles constatations dans la rivière souterraine de Padirac (Lot). Note de M. E.-A. Martel.

France—Surface features. *C. Rd.* **131** (1900): 286–288. **Fabre**
Les ensablements du littoral gascon et les érosions sous-pyrénéennes. Note de M. L. A. Fabre.

Germany. **Baedeker.**
Northern Germany as far as the Bavarian and Austrian Frontiers. Handbook for Travellers by Karl Baedeker. With 34 Maps and 65 Plans. Thirteenth revised edition. Leipsic: Karl Baedeker; London: Dulau & Co. 1900. Size 6½ × 4½, pp. xxxiv. and 430. *Price* 8*m.* *Presented by Messrs. Dulau & Co.*

Germany—Baltic. **Westphal.**
Veröffentlichung des Königl. Preussischen Geodätischen Institutes. Neue Folge, No. 2. Das Mittelwasser der Ostsee bei Travemünde, Marienleuchte, Wismar, Warnemünde, Arkona und Swinemünde in den Jahren 1882–1897. Bearbeitet von Prof. Dr. A. Westphal. Berlin: P. Stankiewicz, 1900. Size 11½ × 9, pp. 144. *Diagrams. Presented by the Institute.*

On the mean level of the water in the Baltic at various German ports, with tables of variations.

Germany—Dunes. *Globus* **78** (1900): 48–52. **Roth.**
Die deutschen Dünen und ihr Bau. Von Dr. E. Roth. *With Sketch-maps and Illustrations.*

Based on the official publication recently issued under the editorship of Paul Gerhardt.

Germany—Ethnography. **Bremer.**
Ethnographie der germanischen Stämme. Von Otto Bremer. Strassburg: Karl J. Trübner, 1900. Size 10½ × 7, pp. xii. and 216. *Maps. Price* 6*s.*

Germany—Meteorology. ———
Veröffentlichungen des K. Preussischen Meteorologischen Instituts. Ergebnisse der Gewitter-Beobachtungen im Jahre, 1897. Berlin: A. Asher & Co., 1899. Size 13½ × 10, pp. xl. and 20. *Presented by the Institute.*

Germany—Meteorology. ———
Veröffentlichungen des K. Preussischen Meteorologischen Instituts. 1899, Heft ii. Ergebnisse der Beobachtungen an den Stationen ii. und iii. Ordnung im Jahre, 1899, zugleich Deutsches Meteorologisches Jahrbuch für 1899 Beobachtungssystem des Königreichs Preussen und benachbarter Staaten. Berlin: A. Asher & Co., 1900. Size 13½ × 10, pp. 63–122. *Presented by the Institute.*

Germany—Prussia. *Naturw. Wochenschrift* **15** (1900): 337–343. **Brick.**

Die Provinz Westpreussen und ihre Naturdenkmäler. Von Dr. C. Brick.

Deals chiefly with the forestry of West Prussia.

Germany—Prussia. *Globus* **78** (1900): 59–61. **Hansen.**

Zur geographischen Verteilung der Personennamen Schleswig-Holsteins um 1500. Von R. Hansen.

Greece. **Murray.**

Handbook for Travellers in Greece, including the Ionian Islands, Continental Greece, the Peloponnesus, the Islands of the Aegean, Thessaly, Albania, and Macedonia; and a detailed description of Athens, Ancient and Modern, Classical and Mediæval. Seventh edition. London: John Murray, 1900. Size 7 × 4½, pp. cxx. and 992. *Maps, Plans, and Illustrations. Price* 20*s*. *Presented by the Publisher.*

Holland. **Various Authors.**

La Hollande, géographique, ethnologique, politique et administrative, religieuse, économique, littéraire, artistique, scientifique, historique, coloniale, etc. Par MM. François Bernard, C. H. B. Boot, Louis Bresson, E. Durand-Gréville, Maurice Euoch, A. Flaeg, John Grand-Carteret, Antonin Lefèvre-Pontalis, Louis Legrand, Gustave Lejeal, Lieut.-Colon. Le Marchand, Adrien Mellion, Jan Suys, Jan Ten Brink, Louis Van Keymeulen, Zaborowski. Paris: Librairie Larousse [not dated]. Size 8½ × 6, pp. 464. *Illustrations. Price* 4*s*. 6*d*.

Holland—Amsterdam. **Robinson.**

Trade of Amsterdam for the year 1899. Foreign Office, Annual No. 2439. Size 10 × 6, pp. 12. *Price* 1*d*.

Italy. *B.S.G. Italiana* **1** (1900): 620–628. **Hassert.**

Tracce glaciali negli Abruzzi, nota preliminare del dott. Kurt Hassert. *With Plates.*

On traces of glacial formations in the Appennines.

Italy—Alps. *Mem. S.G. Italiana* **9** (1899): 25–81. **Novarese.**

Le Alpi Piemontesi, del Vittorio Novarese. *With Illustrations.*

ASIA.

Afghanistan. *J.E. India Assoc.* **32** (1900): 32–43. **Colquhoun.**

Afghanistan: the Key to India. By Archibald R. Colquhoun.

Asia—Historical. **Rockhill.**

The Journey of William of Rubruck to the Eastern Parts of the World, 1253–55, as narrated by himself, with two Accounts of the Earlier Journey of John of Pian de Carpine. Translated from the Latin, and edited, with an Introductory Notice, by William Woodville Rockhill. London: Printed for the Hakluyt Society, 1900. Size 9 × 6, pp. lvi. and 304. *Map. Presented by the Hakluyt Society.*

Central and Western Asia. *J. Bombay Br. R. Asiatic S.* **20** (1899): 217–233. **Modi.**

The Etymology of a few towns of Central and Western Asia as given by Eastern writers. By Jivanji Jamshedji Modi.

China. **Colquhoun.**

The "Overland" to China. By Archibald R. Colquhoun. London and New York: Harper & Bros., 1900. Size 9 × 6, pp. xii. and 466. *Portrait, Maps, and Illustrations. Price* 16*s*. *Presented by the Publishers.*

A timely volume dealing in an authoritative way with the conquest and settlement of Siberia, the Siberian-Manchurian railway, Peking past and present, Manchuria, Eastern Mongolia, the Yang-tze valley, South-West China, and Tongking.

China. **Colquhoun.**

The Problem in China and British Policy. By Archibald R. Colquhoun. London: P. S. King & Son, 1900. Size 7½ × 5, pp. 50. *Map. Price* 2*s*. *Presented by the Publishers.*

Urges the importance of securing for Great Britain a preponderating influence in the Yang-tze valley, from which as a centre whatever is possible of a reformed China should be built up. Some useful statistics as to trade, etc., are given. The map does not show the proposed railway of the Peking Syndicate.

China. **Forke**

Von Peking nach Ch'ang-an und Lo-yang. Eine Reise in den Provinzen Chihli, Shansi, Shensi und Honan. Von A. Forke.—Mittheilungen des Seminars für Orientalische Sprachen an der Universität zu Berlin. Jahrg. i. 1 Abt. pp. 1–126. Berlin and Stuttgart: W. Spemann, 1898. Size 10 × 7. *Maps and Illustrations.*

The journey took place in 1892.

China. *Ann. Hydrographie* **28** (1900): 289–292. **Lans.**

Zur Küstenkunde von China. Aus dem Reiseberichte S.M.S. "Iltis," Kommandant Korv.-Kapt. Lans. *With Chart.*

China. **Pinon.**

René Pinon Jean de Marcillac. La Chine qui s'ouvre. Paris: Perrin et Cie, 1900. Size 7½ × 5, pp. xii. and 306. *Maps. Price* 2*s.* 8*d.*

China. **Scidmore.**

China, the Long-Lived Empire. By Eliza Ruhamah Scidmore. London: Macmillan & Co., 1900. Size 8½ × 6, pp. xvi. and 466. *Illustrations. Price* 8*s.* 6*d. net. Presented by the Publishers.*

Miss Scidmore has seized a favourable moment for the production of her book on China, which is full of acute observations of land and people, and very well illustrated by drawings and photographs.

China—Chekiang. *B.S.G. Italiana* **1** (1900): 535–542. **Vannutelli.**

Un' escursione nel Ce-kiang settentrionale. Lettera del L. Vannutelli. *With Plates.*

A recent journey described in a letter from Shanghai, dated February, 1900.

China—Chi-li. ———

Short Military Report on the Province of Chi-li. Compiled in the Intelligence Branch of the Quarter-Master General's Department, Simla. Simla, 1900. Size 10 × 6½, pp. 20. *Map and Plans. Presented by the Assistant Quarter-Master General, Intelligence Branch, Simla.*

This is a pamphlet compiled for the information of the British troops sent from India to carry on military operations against the "Boxers" in China.

China—Hangchow. **Clennel.**

Trade of Hangchow for the year 1899. Foreign Office, Annual No. 2449, 1900. Size 10 × 6, pp. 20. *Price* 1½*d.*

China—Liao-tung. **Bretschneider**

The Russian Territory on the Liao-tung Peninsula. By E. Bretschneider. [In Russian.] St. Petersburg, 1900. Size 9½ × 6½, pp. 18. *Map. Presented by the Author.*

China—Pakhoi. **Nevill-Perkins.**

Trade of Pakhoi for the year 1899. Foreign Office, Annual No. 2437, 1900. Size 10 × 6, pp. 20. *Map. Price* 4½*d.*

China—Railway. *Ann. G.* **9** (1900): 373–376. **Fauvel.**

Le chemin de fer de Peking à Nieou-tchouang. Par M. A. A. Fauvel.

China—Swatow. **Hurst.**

Trade of Swatow for the year 1899. Foreign Office, Annual No. 2443, 1900. Size 10 × 6½, pp. 12. *Price* 1*d.*

China—Yang-tse. *Globus* **78** (1900): 37–44. **Betz.**

Ein Ausflug nach den Yangtze-Grotten. Von Dr. H. Betz. *With Illustrations.*

A description of the Yang-tze gorges.

Eastern Asia. **Barthold.**

Russische Arbeiten über Ostasien. Von W. Barthold.—Mittheilungen des Seminars für Orientalische Sprachen an der Universität zu Berlin. Jahrgang i. 1 Abt. pp. 187–210. Berlin and Stuttgart: W. Spemann, 1898. Size 10 × 7.

Eastern Asia. **Daish.**

Melbourne to Tokio. Notes by the way. By W. Daish, M.D. Melbourne, 1900. Size 7½ × 5, pp. 104. *Frontispiece. Price* 2*s.* 6*d. Presented by the Author.*

Notes by a ship's surgeon on visits to ports in China and Japan.

Eastern Asia—Typhoons. *Ann. Hydrographiques* (1899): 61–198. **Algué**

Les cyclones aux Philippines et dans les mers de Chine. Étude théorique et pratique par le Père José Algué. *With Diagrams.*

French India. **Vismes.**

Trade of Pondicherry for the year 1899. Foreign Office, Annual No. 2440, 1900. Size 9½ × 6½, pp. 10. *Price* 1*d*.

India—Archæology. *J.R. Asiatic S.* (1900): 431–437. **Smith.**

The Buddhist Monastery at Sohnāg, in the Gorakhpur District. By Vincent A. Smith. *With Plans and Plate.*

New light has recently been thrown on the plan of these ruins by excavations to obtain bricks for railway ballast. The main building, which Mr. Smith thinks was undoubtedly a monastery, is 487 feet long.

India—Geological Survey. ——

General Report on the work carried on by the Geological Survey of India for the period from the 1st April, 1899, to the 31st March, 1900. Under the direction of C. L. Griesbach. Calcutta, 1900. Size 10½ × 7½, pp. iv. and 258. *Presented by the Geological Survey of India.*

India—Inscriptions. **Hultzsch.**

Archæological Survey of India, New Imperial Series, volume xxix. South-Indian Inscriptions. Volume iii. Miscellaneous Inscriptions from the Tamil Country. Part i. Inscriptions at Ukkal, Melpadi, Karuvur, Manimangalam, and Tiruvallam. Edited and translated by E. Hultzsch, PH.D. Madras, 1899. Size 13½ × 10, pp. 124. *Illustrations.*

India—Kashmir. **Stein.**

Memoir on Maps illustrating the Ancient Geography of Kaśmīr. By M. A. Stein, PH.D. (Reprinted from the *Journal of the Asiatic Society of Bengal*, vol. lxviii. part i., Extra No. II., 1899.) Calcutta, 1899. Size 10½ × 7, pp. xii. and 224. *Maps. Presented by the Author.*

This work deals first with the sources of our knowledge as regards ancient Kashmir, considering in turn the Greek, Chinese, Arabian, and Indian notices and the Kashmir chronicles. The general geography of Kashmir is then dealt with in detail, and historical changes in lakes and rivers placed on record. Finally, the political geography of ancient Kashmir is worked out with special reference to the boundaries of the subdivisions of the country.

India—Madras. **Walker.**

A Geological Sketch of the Central Portion of Jeypore Zemindari, Vizagapatam District. By T. L. Walker.—General Report, Geological Survey of India, 1899–1900. Pp. 166–176.

AFRICA.

Abyssinia. *La G., B.S.G. Paris* (1900): 25–34. **Michel.**

Resultats géographiques de la mission de Bonchamps. Par M. Ch. Michel. *With Map and Illustrations.*

British East Africa. **Gorges.**

A Journey from Lake Naivasha to the Victoria Nyanza. By Captain G. H. Gorges. (From the *Geographical Journal* for July, 1900.) Size 10 × 6½, pp. 12. *Map and Illustrations.*

British East Africa. **Purvis.**

Handbook to British East Africa and Uganda. By John B. Purvis. London: Sonnenschein & Co., 1900. Size 7½ × 5, pp. viii. and 94. *Maps and Illustrations. Two copies, one presented by the Author, the other by the Publishers.*

A practical little book giving concise notes as to the nature of the countries, climates, peoples, and products of British East Africa, and lists of outfits suited for use in Uganda.

British East Africa—Zanzibar. **Neuhaus.**

Der Obstreichthum der Insel Zanzibar. Von G. Neuhaus.—Mittheilungen des Seminars für Orientalische Sprachen an der Universität zu Berlin. Jahrgang I. 3 Abt. pp. 120–137. Berlin and Stuttgart: W. Spemann, 1898. Size 10 × 7.

On fruit cultivation in Zanzibar island.

British South Africa. ——

The British South Africa Company. Reports on the Administration of Rhodesia, 1897–1898. 1899. Size 10½ × 8½, pp. 406. *Maps.*

Canary Islands. **Croker.**

Trade of the Canary Islands for the Year 1899. Foreign Office, Annual No. 2451, 1900. Size 10 × 6½, pp. 14. *Price* 1*d.*

Cape of Good Hope. **Gill.**

Report of Her Majesty's Astronomer at the Cape of Good Hope to the Secretary of the Admiralty, for the year 1899. London, 1900. Size 12½ × 10, pp. 18.

See note, p. 474.

East Africa—Place-names. **Velten.**

Erklärung einiger ostafrikanischer Ortsnamen. Von C. Velten.—Mittheilungen des Seminars für Orientalische Sprachen an der Universität zu Berlin. Jahrgang i. 3 Abt. pp. 199–204. Berlin and Stuttgart: W. Spemann. Size 10 × 7.

Explanation of the meaning of a number of East African place-names.

East Africa—Swahili. **Velten.**

Sitten und Gebräuche der Suaheli. Von C. Velten.—Mittheilungen des Seminars für Orientalische Sprachen an der Universität zu Berlin. Jahrgang i. 3 Abt. pp. 9–85. Berlin and Stuttgart: W. Spemann, 1898. Size 10 × 7.

Egypt. **Ebers.**

Aegyptische Studien und Verwandtes. Von Georg Ebers. Stuttgart und Leipzig, Deutsche Verlags-Anstalt, 1900. Size 10 × 6½, pp. x. and 518. *Portrait. Price* 8*s.*

A collection of articles by the late celebrated Egyptologist, including chapters on Egyptian excavations, ancient Egyptian literature, a chapter on modern Egypt, and biographies of Johannes Dümichen, Sir P. Le Page Renouf and the Khedive Ismail. A catalogue of Herr Ebers' writings concludes the volume.

Egypt—Census. ———

Recensement Général de l'Égypte, 1er Juin 1897—1er Moharrem 1315. Résultats généraux. Le Caire, 1898. Size 15 × 11, pp. 70.

Egypt—Nile. *J. Manchester G.S.* **15** (1899): 193–200. **Bowes.**

Barrage of the Nile. By Alderman Isaac Bowes.

Egypt and the Sudan. ———

Egypt. No. 1 (1900). Reports by Her Majesty's Agent and Consul-General on the Finances, Administration, and Condition of Egypt and the Soudan in 1899. London: Eyre and Spottiswoode, 1900. Size 13 × 8½, pp. iv. and 62. *Price* 6½*d.*

Referred to in the *Journal* for July (*ante*, p. 102).

French Somaliland. *C. Rd.* **131** (1900): 196–198. **Gennes and Bonard.**

Les roches volcaniques du Protectorat des Somalis. Note de MM. A. de Gennes et A. Bonard.

French West Africa. **Payeur-Didelot.**

Trente Mois au Continent Mystérieux. Gabon-Congo et Côte Occidentale d'Afrique. Par Payeur-Didelot. Préface de J.-V. Barbier. Paris: Berger-Levrault & Cie, 1899. Size 9 × 6, pp. xii. and 404. *Price* 5 *fr.*

This little book contains a great many details regarding the people and products of Gabun and French Congo, with notes on the other French possessions on the West African coast.

French West Africa—Niger. *La G., B.S.G. Paris* (1900): 9–24. **Baillaud.**

Les territoires français du Niger. Leur valeur économique. Par M. E. Baillaud. *With Map and Illustrations.*

German East Africa. **Stierling.**

Die Königsgräber der Wahehe. Von J. Stierling.—Mittheilungen des Seminars für Orientalische Sprachen an der Universität zu Berlin, Jahrgang ii. 3 Abt. pp. 257–262. Berlin and Stuttgart: W. Spemann, 1899. Size 10 × 7. *Illustrations.*

German East Africa—Kilimanjaro. **Widenmann.**

Eine Kilimandscharo-Besteigung bis zu 5500 m. Höhe, von A. Widenmann.—Mittheilungen des Seminars für Orientalische Sprachen an der Universität zu Berlin, Jahrgang ii. 3 Abt. pp. 140–163. Berlin and Stuttgart: W. Spemann, 1899. Size 10 × 7. *Illustrations.*

The ascent here described was made in September, 1895.

German South-West Africa. **Brincker.**

Die Eingeborenen Deutsch-Südwest-Afrikas nach Geschichte, Charakter, Sitten, Gebräuchen und Sprachen (1 Theil). Von P. H. Brincker.—Mittheilungen des

Seminars für Orientalische Sprachen an der Universität zu Berlin. Jahrgang ii. 3 Abt. pp. 125–139. Berlin and Stuttgart: W. Spemann, 1899. Size 10 × 7.

On the people of South-West Africa.

NORTH AMERICA.

Alaska. *Norske G. Selsk. Aarbog* **10** (1898–99): 14–81. **Moe.**

Minder fra Alaska af ingeniør Ole Falk Moe. *With Map and Illustrations.*

American Lakes. **Erskine.**

Shipping and Shipbuilding on the American Lakes. Foreign Office, Miscellaneous, No. 526, 1900. Size 9½ × 6, pp. 26. *Price* 2*d.*

Referred to in the September number of the *Journal* (p. 353).

Canada. **Hanbury.**

A Journey from Chesterfield Inlet to Great Slave Lake, 1898–99 By David T. Hanbury. (From the *Geographical Journal* for July, 1900.) Size 10 × 6½, pp. 16. *Map.*

Canada—Geological Survey. ——

Summary Report of the Geological Survey Department for the year 1899. Ottawa, 1900. Size 10 × 6½, pp. 224. *Map.*

Among the special reports included in this summary are those of Mr. McConnell on the Yukon district (already issued separately); of Mr. Gwillim, on the Atlin district of British Columbia; and of Mr. A. P. Low, on exploration of the East Coast of Hudson bay. A large amount of useful geographical information is contained in them. The map shows the Yukon goldfields on the scale of 2 miles to 1 inch.

Canada—Gulf of St. Lawrence. ——

The Currents in the Gulf of St. Lawrence, including the Anticosti Region, Belle Isle and Cabot Straits. Condensed from the Reports of the Survey of Tides and Currents, for the seasons of 1894, 1895, and 1896. Ottawa, 1900. Size 10 × 6½, pp. 28.

Canada—La Hontan's Journeys. **Nion.**

Un outre-mer au XVII^e^ siècle, voyages au Canada du Baron de La Hontan. Publiés avec une Introduction et des notes. Par M. François de Nion. Paris: Plon-Nourrit et C^ie^, 1900. Size 7½ × 5, pp. xx. and 338. *Price* 2*s.* 8*d.*

Letters written from Canada in 1684 and 1685, describing the exploration of the interior of the country.

Canada—Minerals. **Dawson.**

Paris International Exhibition, 1900. Economic Minerals of Canada. By G. M. Dawson, C.M.G. Printed by direction of the Canadian Commission for the Exhibition, 1900. Size 8 × 4½, pp. 54. *Map.*

Canada—Surveys and Museums. *P. Canadian I.* **2** (1900): 75–89. **Walker.**

Canadian Surveys and Museums, and the need of increased expenditure thereon. President's address. By B. E. Walker.

Mexico. ——

Mexico. A geographical sketch, with special reference to Economic Conditions and Prospects of Future Development. Compiled by the Bureau of the American Republics. Washington, 1900. Size 9½ × 6, pp. 386. *Presented by the Bureau of the American Republics.*

A most useful summary of our knowledge of Mexico, under the heads of geography, history, ethnology, government, agriculture, industries, commerce, etc. There is a fairly complete catalogue of modern works and maps on Mexico.

Mexico—Folklore. **Starr.**

Catalogue of a Collection of Objects illustrating the folklore of Mexico. By Frederick Starr. London: Published for the Folklore Society by David Nutt, 1899. Size 9 × 6, pp. xvi. and 132. *Illustrations. Presented by the Publisher.*

The collection here described, which illustrates divers phases of Mexican life, was presented by Mr. Starr to the Folk-lore Society.

North America—Geology. **Weeks.**

B.U.S. Geolog. Surv., No. 156 (1898): 1–130; No. 162 (1899): 1–164.

Bibliography and Index of North American Geology, Paleontology, Petrology, and Mineralogy for the years 1897 and 1898. By F. B. Weeks.

United States—Altitudes. *B.U.-S. Geolog. Surv.*, No. 160 (1899): 1-776. **Gannett.**

A Dictionary of Altitudes in the United States. (Third edition.) Compiled by Henry Gannett.

The purely geographical grouping of the points of which the height above sea-level is known which was adopted in the previous edition of this list has been abandoned, and the alphabetical order restored in the present. Now the list is given alphabetically under each state, the names of the states being also arranged in alphabetic order.

United States—California. **Perrine.**

B.U.-S. Geolog. Surv., No. 155 (1898): 1-46; No. 161 (1899): 1-30.

Earthquakes in California in 1896 and 1897, and 1898. By C. D. Perrine.

United States—Geology. *B.U.S. Geolog. Surv.*, No. 150 (1898): 1-400. **Diller.**

The Educational Series of Rock Specimens collected and distributed by the United States Geological Survey. By J. S. Diller. *With Illustrations.*

United States—Illinois. **Leverett.**

The Illinois Glacial Lobe. By Frank Leverett. (Monographs of the United States Geological Survey. Vol. xxxviii.) Washington, 1899. Size 12 × 9½, pp. xxii. and 818. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

United States—Iowa. **James.**

Constitution and Admission of Iowa into the Union. By James Alton James, PH.D. (Johns Hopkins University Studies. Series xviii. No. 7.) Baltimore, 1900. Size 9½ × 6½, pp. 54.

United States—Irrigation. **Mead.**

Rise and Future of Irrigation in the United States. By Elwood Mead.—Yearbook of the United States Department of Agriculture, 1899. Washington, 1900. Size 9½ × 6, pp. 591-612. *Illustrations. Presented by the U.S. Department of Agriculture.*

This paper traces the history of irrigation in the western states, describes the work now being carried on, and discusses future developments.

CENTRAL AND SOUTH AMERICA.

Argentine Republic. ———

Anuario de la Dirección General de Estadistica correspondiente al Año 1898. Tomo I. Buenos Aires, 1899. Size 11 × 7½, pp. xxviii. and 494.

Exhaustive statistics of the commerce and shipping of Argentina.

Bolivia. *National G. Mag.* **11** (1900): 209-224, 264-280. **Curtis.**

The Road to Bolivia. By William E. Curtis. *With Illustrations.*

Brazil—Amazon. *J. Manchester G.S.* **15** (1899): 185-192. **Jones.**

A Thousand Miles up the Amazon. By Joseph Jones. *With Illustrations.*

Brazil—Discovery. ———

Instituto Geographico e Historico da Bahia. Revista commemorativa do Quarto Centenario do Brazil. Anno VII. vol. vii. No. 23. Bahia, 1900. Size 9½ × 6½, pp. 78. *Map. Presented by the Institute.*

Brazil—Porto Alegre. **Archer.**

Trade of Porto Alegre for the year 1899. Foreign Office, Annual No. 2451, 1900. Size 10 × 6½, pp. 14. *Price* 1*d.*

Brazil—Trombetas. **Coudreau.**

O. Coudreau. Voyage au Trombetas 7 Août 1899—25 Novembre 1899. Paris: A. Lahure, 1900. Size 11½ × 9, pp. 142. *Maps and Illustrations. Price* 6*s.* 6*d.*

This work describes the last and fatal journey of the well-known explorer Henri Coudreau, who, between 1895 and his death in 1899, had devoted himself to the exploration of the Amazon tributaries in the State of Para, including the Tapajos and Xingu, as well as the Tocantins and Araguaya. The illustrations, from photographs, give an excellent idea of Brazilian river scenery, and the large-scale charts of the Trombetas and its branches are a valuable addition to our knowledge of that imperfectly known stream. The author was second in command of the expedition.

Chile. *Ann. Hydrographie* **28** (1900): 292-299. **Herrmann.**

Valparaiso. Bearbeitet durch J. Herrmann. *With Plan.*

Cuba—Census. *B. American G.S.* **32** (1900): 281–286. **Gannett.**
The Results of the Cuban Census. By Henry Gannett.

The United States census of Cuba in October, 1899, showed a total population of 1,573,000; the last Spanish census in 1887 gave 1,632,000.

Danish West Indies. *Export* **22** (1900): 412–414. ———
Dänemarks westindische Besitzungen.

Ecuador—Degree measurement. *La G., B.S.G. Paris* (1900): 1–8. **Maurain.**
Reconnaissance de l'arc du méridien de Quito. Par M. E. Maurain. *With Map and Illustrations.*

Ecuador—Degree measurement. *C. Rd.* **131** (1900): 215–236. **Poincaré.**
Rapport sur le projet de revision de l'arc meridien de Quito. Par M. Poincaré. *With Map.*

These two articles are referred to, *ante*, p. 356.

Paraguay—Chaco Boreal. *Scottish G. Mag.* **16** (1900): 418–429. **Grubb.**
The Chaco Boreal: the Land and its People. By W. Barbrooke Grubb.

Mr. Grubb has spent eleven years in the northern Chaco as a missionary, and gives a full and interesting account of the general characteristics of the country and people.

Peru. ———
Sinopsis geográfica y estadistica del Peru, 1895–1898. Lima, 1899. Size 11 × 7½, pp. 208.

Peru. **Cisneros and Garcia.**
Carlos B. Cisneros, Rómulo E. Garcia, El Perú en Europa. Lima: Guzman, 1900. Size 7½ × 5½, pp. x. and 104.

A description of Peru and its resources, designed to show the attractions which that country may present to European immigrants.

Porto Rico. *B. American G.S.* **32** (1900): 220–238. **Wilson.**
Porto Rico: its Topography and Aspects. By Herbert M. Wilson. *With Map.*

The author accompanied Mr. R. T. Hill as topographer in his geological reconnaissance of the island.

West Indies—Dudley's Voyage. **Warner.**
The Voyage of Robert Dudley, afterwards styled Earl of Warwick and Leicester and Duke of Northumberland, to the West Indies, 1594–1595, narrated by Capt. Wyatt, by himself, and by Abram Kendall, Master. Edited by George F. Warner. London: Printed for the Hakluyt Society, 1899. Size 9 × 6, pp. lxvi. and 104. *Portrait and Map. Presented by the Hakluyt Society.*

AUSTRALASIA AND PACIFIC ISLANDS.

Caroline Islands. *M.G. Ges. Hamburg* **16** (1900): 71–138. **Kubary.**
Beitrag zur Kenntniss der Núkuóro oder Monteverde-Inseln (Karolinen). Von J. Kubary. *With Illustrations.*

Melanesia. **Chewings.**
Amongst Tropical Islands; or, Notes and Observations made during a visit of the s.s. *Moresby*, in 1899, to New Guinea, New Britain, and the Solomon Islands. By a Passenger (Hannah Chewings). Adelaide: J. L. Bonython & Co., 1900. Size 7½ × 5, pp. 36. *Presented by the Author.*

A reprint of letters originally contributed to a newspaper.

New South Wales. **Carne.**
New South Wales. Mineral Resources, No. 7. Mercury, or "Quicksilver," in New South Wales, with Notes on its Occurrence in other Colonies and Countries. By J. E. Carne. Sydney, 1900. Size 10 × 6½, pp. 36. *Sketch-Map and Plan. Presented by the Geological Survey, New South Wales.*

Samoa. *Globus* **78** (1900): 31–33. **Bülow.**
Die Namen der Samoa-Inseln. Von W. V. Bülow. *With Illustration.*

On the various names which have from time to time been applied to the Samoa islands.

POLAR REGIONS.

Antarctic. *Globus* **77** (1900): 345–352, 365–371. **Schott.**
Die deutsche Tiefsee-Expedition auf dem Dampfer *Valdivia* im südlichen Eismeer. Von Dr. Gerhard Schott. *With Map and Illustrations.*

Antarctic—Belgian Expedition. *B.S.R. Belge G.* **24** (1900): 93–175. **Arçtowski.**
Géographie physique de la région antarctique visitée par l'Expédition de "la Belgica." Par Henryk Arçtowski. *With Maps and Illustrations.*

Antarctic—Belgian Expedition. *B.S.R. Belge G.* **24** (1900): 29–52. **Lecointe.**
Aperçu des travaux scientifiques de l'Expédition antarctique belge. Par M. Georges Lecointe. *With Illustrations.*

Antarctic—Belgian Expedition. *B.S.R. Belge G.* **24** (1900): 53–92. **Lecointe.**
L'hydrographie dans le détroit de la "Belgica" et les observations astronomiques et magnétiques dans la zone australe. Par M. Georges Lecointe. *With Illustrations.*

Antarctic—Belgian Expedition. *B.S.R. Belge G.* **24** (1900): 7–28. ———
Expédition antarctique belge. *With Illustrations.*

The whole of the January—February number of this *Bulletin* is occupied by a report of the *Belgica* expedition, including the separate reports of each member of the staff on his particular work.

Antarctic—Biology. *B.S.R. Belge G.* **24** (1900): 177–230. **Racovitza.**
La vie des animaux et des plantes dans l'Antarctique. Par Emile G. Racovitza. *With Illustrations.*

Arctic—Peary's Expedition. *B. American G.S.* **32** (1900): 245–248. **Bridgman.**
Mr. H. L. Bridgman on Peary's Work.

A summary of the trip of the *Diana* with supplies to Mr Peary in 1899, with notes of his proposed plan of action for 1900.

Greenland. **Nathorst.**
Den svenska expeditionen till nordöstra Grönland 1899. Af A. G. Nathorst. (Ur Ymer, Årg. 1900. H. 2.) Size 9½ × 6¼, pp. 115–156. *Maps and Illustrations. Presented by the Author.*

MATHEMATICAL GEOGRAPHY.

Azimuth Tables—Star. **Davis.**
Star's True Bearing or Azimuth Tables, computed for intervals of ten minutes between the Parallels of Latitude 30° and 60° inclusive. By Percy L. H. Davis. London: J. D. Potter, 1900. Size 9½ × 6, pp. 108. *Price* 6*s. Presented by the Author.*

Azimuth Tables—Sun. **Davis.**
Sun's True Bearing or Azimuth Tables, computed for intervals of four minutes between the Parallels of Latitude 30° N. and 30° S. inclusive, with Instructions for using the Tables in Danish, Dutch, French, German, Italian, Portuguese, Russian, and Spanish. By Captain John E. Davis and Percy L. H. Davis. London: J. D. Potter, 1900. Size 9½ × 6, pp. xxvi. and 256. *Price* 10*s.* 6*d. Presented by the Author.*

Cartography. **Lamprecht and Kötzschke.**
Ueber Historische Grundkarten. A. Zur Organisation der Grundkartenforschung, von Karl Lamprecht. B. Die Technik der Grund-Karteneinzeichnung, von Rudolf Kötzschke. Sonderabdruck aus Deutsche Geschichtsblätter, Monatsschrift zur Förderung der landesgeschichtlichen Forschung, herausgegeben von Dr. Armin Tille. (Heft 2, November 1899 und Heft 5, Februar 1900.) Gotha, F. A. Perthes, 1900. Size 9½ × 6½, pp. 30. *Price* 9*d.*

Proposal for a map of Germany on the scale of 1 : 100,000, showing by a great variety of signs the nature of the population centres, boundaries of ecclesiastical as well as political divisions, the nature of the proprietorship, and method of cultivation of the land, etc.

Cartography. ———
Table des Légendes latines, hollandaises et italiennes d'un Atlas Ancien contenant des Cartes hydrographiques et géographiques du xvi^{ème} et du xvii^{ème} siècles. Avec des traductions française, Anglaise et castillane. Blanes, 1900. Size 9 × 6½, pp. 40. *Presented.*

Cartography—War Maps. *J.R. United Service I.* **44** (1900): 758–776. **Holdich.**
War Maps. By Colonel Sir T. H. Holdich, K.C.I.E.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Aurora. **Arctowski.**

Observations on the Aurora Australis. By Henryk Arctowski. (From the *Geographical Journal* for July, 1900.) Size 10 × 6½, pp. 4.

Biology. *Quarterly Rev.* **192** (1900): 199–216. ——

New Creatures for Old Countries.

On acclimatisation, chiefly with reference to the experiments carried on at Haggerstone Castle, Leonardslee, and Woburn Abbey. The herds of deer, etc., at the last-named are described as a spectacle never to be forgotten, only to be compared with those seen in East Africa.

Botanical Geography. *La G., B.S.G. Paris* (1900): 35–40. **Masclef.**

La Géographie botanique et son évolution au XIX^e^ siècle. Par M. A. Masclef.

Climatological Maps. *Meteorolog. Z.* **17** (1900): 241–257. **Meinardus.**

Eine einfache Methode zur Berechnung klimatologischer Mittelwerthe von Flächen. Von Dr. Wilh. Meinardus.

On the calculation of mean values of climatological data for surfaces.

Geomorphology. *B.S.G. Italiana* **1** (1900): 522–534, 601–619. **Borzino.**

Valli aperte, frammenti di geografia fisica e sociale del colonnello C. Borzino. *With Map.*

Geomorphology. *Mem. S.G. Italiana* **9** (1899): 3–24. **Porena.**

Della Morfologia della superficie terrestre nella Geografia e dei tipi di rilievo colla nomenclatura in italiano. Del Prof. F. Porena.

This paper discusses the nomenclature of terrestrial features and the terminology of processes, suggesting suitable Italian forms for the foreign words in use in other countries.

Glacial Deposits. *M.G. Ges. Hamburg* **16** (1900): 139–230. **Petersen.**

Geschiebestudien. Beiträge zur Kenntniss der Bewegungsrichtungen des diluvialen Inlandeises. Von Dr. Johannes Petersen. Zweiter Theil. *With Maps.*

Meteorology at Sea. *Ann. Hydrographiques* (1899): 21–29. ——

Note sur le dépouillement des journaux météorologiques des bâtiments de commerce (année 1898).

The names of the ships and their captains, from whose records meteorological observations are sent to the French Ministry of Marine, are here recorded, together with the name of the five best observers to whom the French Government has awarded prizes for the excellence of their work.

Meteorology—Cyclones. *B. American G.S.* **32** (1900): 249–259. **Cordeiro.**

Tropical Hurricanes. By F. J. B. Cordeiro. *With Diagrams.*

Meteorology—Cyclones. *C. Rd.* **131** (1900): 132–135. **Poincaré.**

Combinaison des effets des révolutions synodique et tropique de la Lune: son action sur la marche des dépressions. Note de M. A. Poincaré.

Meteorology—Earth Temperature. **Homén.**

Öfversigt Finska Vet.-S. Förhandlingar **40** (1897–98): 80–107.

Om jordtemperatur bestämningar. Af Theodor Homén.

On methods of earth-thermometry, and results in different soils in Finland.

Meteorology—Pressure. *Meteorolog. Z.* **17** (1900): 257–274. **Fischer.**

Ein neues Barometer. Von Dr. K. T. Fischer.

This new form of barometer is on the principle of the Cartesian Diver, and takes the form of an "atmospheric-pressure areometer." The instrument is described in minute detail.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropology. **Deniker.**

Les Races et les Peuples de la Terre. Éléments d'Anthropologie et d'Ethnographie. Par J. Deniker. Paris: Schleicher Frères, 1900. Size 7½ × 5, pp. vi. and 692. *Illustrations. Price* 10*s.* 6*d.*

A clearly expressed and amply illustrated sketch of the main facts regarding the classification and the characteristics of the human race.

Commercial Geography. *Deutsche G. Blätter* **23** (1900): 77–96. **Fulst.**

Kohlenstationen und Flottenstützpunkte. Von Dr. O. Fulst.

On coaling and naval stations.

Commercial Geography—Tea. *J.S. Arts* **48** (1900): 668–671. ———

The Geography of Tea.

Extracts from an anonymous paper in the *Tropical Agriculturist* of Ceylon.

Historical—De Quiros. *R.G.S. Australasia* (*Victoria*) **18** (1900): 7–20. **Bevan.**

Did De Quiros land in Queensland? A Reply to Cardinal Moran. By Theodore F. Bevan.

This is referred to in the *Journal*, p. 479.

Historical—Egyptian Text. *P.S. Biblical Archæology* **22** (1900): 155–160. **Wiedemann.**

A Mythological-Geographical Text. By Prof. Dr. A. Wiedemann.

On an old Egyptian religious text containing some remarks on the early conceptions of geography.

Historical—Marco Polo. *Le Globe, B.S.G. Genève* **39** (1900): 84–94. **Chaix.**

Marco Polo. Par M. Paul Chaix.

Historical—Papal Demarcation. **Dawson.**

The Lines of Demarcation of Pope Alexander VI. and the Treaty of Tordesillas, A.D. 1493 and 1494. By Samuel Edward Dawson. (From the *Transactions* of the Royal Society of Canada. Second Series—1899–1900. Vol. v. Section ii.) Ottawa: J. Hope & Sons, 1899. Size 10 × 6½, pp. 467–546. *Maps.*

This discusses the famous lines of demarcation between the spheres of Spanish and Portuguese influence from the points of view of historical fact and international law.

Historical Maps. ———

Die wechselnden Phasen im geschichtlichen Sehkreis occidentalischer Cultur. Kartographisch skizzirt mit einleitendem Text. I. Berlin: D. Reimer (Ernst Vohsen), 1900. Size 10 × 6½, pp. 30. *Maps. Price* 1*s.* 6*d.*

A series of small maps showing the gradual growth of the area in which intercommunication of different peoples from the centres of Western culture was practicable at various historical periods.

BIOGRAPHY.

Baumann. *Abh. k.k. G. Ges. Wien* **2** (1900): 1–20. **Haberlandt.**

Dr. Oskar Baumann. Ein Nachruf. Von Dr. M. Haberlandt. *With Portrait.*

Biographical Dictionary. **Lee.**

Dictionary of National Biography. Edited by Sidney Lee. Vol. lxiii. Wordsworth-Zuylestein. London: Smith, Elder & Co., 1900. Size 10 × 7, pp. xxiv. and 436. *Price* 15*s.* Also Indexes to vols i. to xiv.

The following names of geographical interest are included among the notices in this volume: Sir Richard Worsley, by Warwick Wroth; Edward Wright, by Prof. J. K. Laughton; James Wild, by G. le Grys Norgate; Thomas Wyndham, by A. F. Pollard; Sir Henry Yule, by Coutts Trotter. The splendid undertaking now completed forms a monument to British enterprise, as well of the living publishers and editors as of the famous dead whose biographies it enshrines.

Champlain. **Gravier.**

Gabriel Gravier. Vie de Samuel Champlain, fondateur de la Nouvelle-France (1567–1635). Paris: J. Maisonneuve & C^ie^, 1900. Size 9 × 7, pp. xxvi. and 374. *Map and Portrait. Price* 16*s.*

Biography of the great French explorer, with details of his journeys of exploration and of the foundation of the French colonies on the St. Lawrence.

Dampier. **Verbeek.**

Deutsche G. Blätter **22** (1899): 203–235; **23** (1900): 28–58, 109–142.

William Dampiers Leben und Werke. Von Dr. Paul Verbeek.

d'Escayrac de Lauture. **Durand-Lapie.**

Le Comte d'Escayrac de Lauture, voyageur et explorateur français. Commandeur de la Légion d'honneur. Sa vie et ses ouvrages par Paul Durand-Lapie. Paris: H. Champion, 1899. Size 9 × 6, pp 180. *Presented by the Author.*

Feilden. *Geolog. Mag.* 7 (1900): 289-294. **Bonney.**

Colonel Feilden's Contributions to Glacial Geology. By Prof. T. G. Bonney, D.Sc., etc.

Marinelli. *B.S.G. Italiana* 1 (1900): 629–654. **Vedova.**

Giovanni Marinelli. Commemorazione letta il 14 giugno 1900 dal Prof. G. Dalla Vedova. *With Portrait.*

This appreciative biography of Prof. Marinelli concludes with a list of 210 papers contributed by him to various journals from 1867 to 1899.

GENERAL.

Bibliography. **Knox.**

Geographical Index (Extra-European) to Books, Periodicals, etc. Compiled in the Intelligence Division, War Office, by Alexander Knox. 1899. With Index of Names for the years 1895–99. London: Harrison & Sons. Size 11 × 7½, pp. cx. and 92. *Presented by the War Office.*

British Empire. *National G. Mag.* 11 (1900): 249–263. **Mead.**

The Expansion of England. By Edwin D. Mead, LL.D.

Church Missionary Society. ———

Proceedings of the Church Missionary Society for Africa and the East. 1899–1900. London: Church Missionary House, 1900. Size 8½ × 6, pp. xcvi., 518, and (436). *Maps. Presented by the Church Missionary Society.*

Maps are given showing all the stations of the Church Missionary Society and the boundaries of the dioceses of the missionary bishops.

Field Testing. **Merritt.**

Field Testing for Gold and Silver. A practical Manual for Prospectors and Miners. By Wm. Hamilton Merritt. London: Crosby Lockwood & Son, 1900. Size 6 × 4, pp. x. and 144. *Illustrations. Price 5s. net. Presented by the Publishers.*

A compact and clearly printed pocket-guide for field work in the detection of precious metals, designed for the use of prospectors.

Foreign Missions. ———

Free Church of Scotland. Seventieth Report on Foreign Missions to the General Assembly of the Free Church of Scotland. May, 1900. Edinburgh, 1900. Size 8½ × 5½, pp. 112.

French Colonies. **Vignon.**

L'exploitation de notre Empire colonial. Par Louis Vignon. Paris: Hachette et C^ie^, 1900. Size 7½ × 5, pp. 356. *Price* 3.50 *fr.*

Discusses the principles and methods of French colonization by the action of the Government in every detail, and contrasts it unfavourably with the results of individual enterprise as shown in the British colonies.

German Colonies. ———

Jahresbericht über die Entwickelung der Deutschen Schutzgebiete im Jahre 1897–98. (Beilage zum Deutschen Kolonialblatt 1899.) Berlin, 1899. Size 12½ × 9, pp. 218.

German Colonies. ———

Jahresbericht der Deutschen Kolonialgesellschaft. 1899. Berlin, 1900. Size 9½ × 6½, pp. 76.

German Colonies. ———

Weissbuch. Zwanzigster Theil. Berlin: C. Heymann, 1900. Size 13 × 9½, pp. 318.

Progress reports for 1898–99 on the various German colonies in Africa and the Pacific, with statistics of trade, agriculture, etc.

German Colonies. **Hauser.**

Études d'Économie Coloniale. Premier fascicule. Colonies Allemandes, impériales et spontanées. Par Henri Hauser. Paris: Nony et C^ie^, 1900. Size 9 × 6, pp. x. and 142.

A reprint, with corrections and additions, of articles which originally appeared in *Questions Diplomatiques et Coloniales.* The author regards Kiau-chou as the most favourably placed of all the German possessions.

NEW MAPS.

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England and Wales. **Ordnance Survey.**

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ENGLAND AND WALES (revision):—**Anglesey**, II. 7, 13; III. 5, 6, 11, 14, 15; VI. 1, 3; X. 4; XI. 1, 11, 14; XII. 6; XVI. 3, 4, 7, 8; XVII. 6, 8, 10, 11, 12, 15, 16; XVIII. 2, 9, 11, 12, 13, 14, 15, 16; XIX. 13; XXI. 2, 3, 6, 11, 12; XXII. 3, 5, 11, 12, 14; XXIII. 1, 2, 5, 9; XXIV. 4. **Carnarvon**, IV. 12, 16; V. 6; VII. 4; X. 12; XI. 2, 4, 5, 7, 9; XII. 7, 11; XIV. 1; XXIII. 8; XXIX. 1, 4, 5, 6, 11; XXX. 1; XXXI. 16; XXXVI. 10; XXXVII. 9, 10; XXXVIII. 1, 3, 10, 11; XLIV. 2; XLVI. 2, 4; LI. 3. **Cumberland**, XXXV. 10, 11, 14, 15; XXXVI. 13, 14, 15, 16; XXXVII. 11, 14, 15, 16; XXXVIII. 14, 15, 16; XXXIX. 13, 15; XL. 3, 11, 13, 15; XLIV. 4; XLV. 1, 2, 4, 6, 7, 11; XLVI. 1, 2, 3, 6; LIII. 8. **Derbyshire**, XXXVI. 13; XL. 4, 11; XL. 9, 13; XLIII. 2; XLIV. 12; XLVI. 5. **Glamorganshire**, XI. 16; XVIII. 4, 7, 8, 11, 15, 16; XIX. 7, 9, 10, 11, 13, 15; XXVII. 2, 3, 4; XXVIII. 1, 3, 5, 6, 9; XXXVI. 8, 12, 16; XLVI. 4, 8; L. 7 and 11. **Northampton**, XXVIII. 11, 12, 15; XXIX. 2, 7, 8, 9, 10, 12, 13, 14, 15, 16; XXX. 2, 4, 7, 8, 12, 15; XXXVI. 1, 2, 3, 5, 7, 9; XXXVII. 2, 3, 4, 6, 7, 8, 12; XXXVIII. 2, 4, 5, 8, 9, 12; XXXIX. 5; XLIII. 8, 12; XLIV. 1, 5, 9; XLVI. 6, 7, 10, 11; XLIX. 4; LI. 7; LII. 3, 4. **Notts**, XXVII. 13; XXXII. 2, 3, 4, 6, 8, 9, 11, 13; XXXIIA. 4; XXXIII. 9, 12, 15; XXXVII. 5; XXXIX. 2, 3, 6, 10, 11, 14, 15, 16; XL. 1, 2, 16; XLIV. 1, 2, 3, 6, 7, 10, 11. **Staffs**, XVIII. 2, 5, 7, 9; XX. 9. **Wiltshire**, X. 7, 8, 11, 12; XI. 9; XV. 1, 5; XX. 10; XXI. 4, 13, 14; XXII. 1, 5, 6, 11, 13; XXV. 1, 3, 5, 6, 7; XXVIII. 9, 10, 15, 16; XXXV. 2, 6; XXXVI. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 15; XXXVII. 9, 10, 13, 14; XLIII. 2, 3, 6, 7, 9, 14. 3*s.*

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Germany, etc. **Grundy.**

Murray's Handy Classical Maps. Germania, etc. Edited by G. B. Grundy, M.A., of Brasenose College, Oxford. London: John Murray. *Price* 1*s. Presented by the Publisher.*

In addition to the two principal maps of Germania, Rhetia, and Noricum (1:3,700,000), and Thracia, Mœsia, Illyria, Pannonia, and Dacia (1:3,950,000), this sheet also contains an inset of the Bosphorus and another showing "Germania Magna" according to Ptolemy. With the exception of the latter, these, like others of the series to which they belong, are orographically coloured, and a useful index to the ancient place-names is given.

Greece. **Curtius and Kaupert.**

Karten von Attika. Scale, 1:100,000 or 1·6 stat. miles to an inch. Auf Veranlassung des Kaiserlich Deutschen Archäologischen Instituts und mit Unterstützung des K. Preussischen Ministeriums der geistlichen, Unterrichts- und Medicinal-Angelegenheiten aufgenommen durch Offiziere und Beamte des K. Preussischen Grossen Generalstabes, mit erläuterndem Text herausgegeben von E. Curtius und J. A. Kaupert. Übersichts oder Gesammt-Karte von Attika; Heft IX. Lieferung, 2; Inhalt: Titel- und Zeichen-Erkl.: Blatt 3, Athen-Peiraieus; 4, Salamis; 6, Kephisia; 7, Eleusis; 9, Oropos; 10, Theben. Ergänzungsblatt, Aegina. 1900. Dietrich Reimer (Ernst Vohsen) Berlin.

This part contains seven sheets and the index diagram of a beautifully executed general map of Attica, now being published on a reduced scale, in continuation of this

atlas, which has been in progress for years past. The map is printed in colours, and is on the scale of 1 : 100,000, while the larger maps previously issued were on the scale of 1 : 25,000. It is accompanied by a volume of explanatory letterpress.

ASIA.

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 4 miles to an inch. Sheets: 15, parts of districts Rawal Pindi, Jhelum, Kohat, Bannu, Dera Ismail Khan, and Shapur (Punjab), additions to 1897; 17, district Multan and parts of districts Muzaffargarh, Jhang, Dera Ghazi Khan, Dera Ismail Khan, and Montgomery; parts of native states of Bahawalpur (Punjab), and Bickaner (Rajputana Agency), additions to 1898; 61, parts of districts Malabar, Coimbatore, Madura, and Salem (Madras Presidency), and of district Mysore (Mysore Native State) and Coorg, additions to 1899; 88, districts Jaunpur and parts of districts Allahabad, Azamgarh, Benares, Fatehpur, Mirzapur, and Banda (N.W. Provinces), districts Rae Bareli, Partabgarh, and Sultanpur (Oudh), additions to 1898; 116, parts of districts Katak, Puri, and Tributary States of Baramba, Nayagur, Ranpur, Tigiria, etc. (Bengal), additions to 1899; 106, part of district Sambalpur and Garhjat States of Raigarh, Sarangarh, Sonpur, Rairakhol, and Bamra (Central Provinces), and Baud, Athmallik, and Angul (Orissa Tributary States), additions to 1898. Quarter-Sheets: 31 S.E., parts of districts Hissar and Ferozepur and Native States of Patiala (Punjab) and Bickaner (Rajputana Agency), additions to 1898; 31 S.W., parts of district Ferozepur and Native States of Bahawalpur (Punjab) and Bickaner (Rajputana Agency), 1898; 48 N.W., parts of districts Umballa, Ludhiana, and Karnál, and of Patiala, Nabha Jind Maler Kotla, and Kalsia Native States (Punjab), additions to 1897; 48 S.W., parts of districts Hissar and Karnál and Native States of Patiala and Jind (Punjab), 1899; 52 N.E., parts of districts Sangor (Central Provinces), Jhansi (N.W. Provinces), and of Native States of Gwalior (C. I. Agency), Tonk, and Jhallawar (Rajputana Agency), 1899; 70 S.E., parts of districts Damoh and Jubbulpore (Central Provinces), and of Native States Panna, Ajaigarh, and Maihar (C. I. Agency), 1899; 70 S.W., parts of districts Sangor and Damoh (Central Provinces), Jhansi (N.W. Provinces), and of Native States Gwalior, Bhopal, and Panna (C. I. Agency), 1898; 71 S.W., parts of districts Narsinghpur, Hoshangabad, Betúl, Chhindwara, and Seoni (Central Provinces), and Native State of Bhopal (C. I. Agency), 1899; 87 N.W., parts of districts Kheri, Bahraich, Sitapur, Bara Banki, and Gonda (Oudh), 1898; 125 S.E., parts of districts Sylhet, Cachar, and North Lushai Hills (Assam), 1898; 126 S.E., parts of districts Noakhali Chittagong and Native State of Hill Tippera (Bengal), and North and South Lushai Hills (Assam), 1898; 131 N.W., parts of districts Cachar and Naga Hills and Manipur Native State (Assam), 1899.—Central India and Rajputana Survey, 1 inch to a mile. Nos. 205, parts of Native States Oodeypore and Tonk (Rajputana Agency), and of Gwalior and Indore (C. I. Agency), 1891; 410, parts of Bhopal State (C. I. Agency), and of districts Saugor and Narsinghpur (Central Provinces). Seasons 1862–63 and 1871–72, 1899; 471, parts of districts Bilaspur and Mandla (Central Provinces), and Native State of Rewah (C. I. Agency). Season 1871–72. 1899.—North-West Provinces and Oudh Survey, 1 inch to a mile. No. 15, districts Saháranpur and Múzaffarnagar. Seasons 1878–80. 1898.—Punjab Survey, 1 inch to a mile. No. 82, part of district Kohát (Punjab). Season 1882–83, 1899.—Sind Survey, 1 inch to a mile. Nos. 34, 35, district Karachi. Seasons 1894–96. 1899. 48, districts Hyderabad and Karachi. Seasons 1893–94 and 1897–98. 1899. 49, district Hyderabad. Seasons 1894–95 and 1897–98. 1899. 69, 88, 89, districts Hyderabad and Thar and Párkar. Season 1897–98. 1899. 106, 107, district Thar and Párkar. Season 1897–98. 1899.—Upper Burma Survey, 1 inch to a mile. Nos. 305, part of Northern Shan States. Season 1896–97. 1899. 307, parts of districts Mandalay, Kyaukse, and Northern Shan States. Seasons 1895–97. 1899. 351, part of Northern Shan States. Season 1896–97. 1899. 358, part of Southern Shan States. Season 1894–95. 1898. 360, Southern Shan States. Season 1895–96. 1899. 361, the Myelat and Southern Shan States Season 1895–96. 1899. 398, parts of Northern Shan States. Season 1897–98. 1899. 458, parts of Southern Shan States. Season 1897–98. 1899.—Map of the North-West Provinces and Oudh, 32 miles to an inch, 1899.—District Barrang, 4 miles to an inch, 1899.—District Tippera, 8 miles to an inch, 1899.—District Chhindwara (Central Provinces), 8 miles to an inch, 1899.—District Nimar (Central Provinces), 8 miles to an inch, 1899.—India, to illustrate the gauges of the railways, 1899, 80 miles to an inch.—India, 96 miles to an inch, 1898.—India, 128 miles to an inch, 1898.—Bengal, index map showing scales of publication,

1899.—Bengal, index map showing scales of survey, 1899.—North-West Provinces and Oudh, index map showing scales of survey, 1899.—North-West Provinces and Oudh, index map showing scales of publication, 1899.—Conventional signs and terms used in Military Topography. *Presented by H.M. Secretary of State for India, through India Office.*

Palestine, etc. **Grundy.**

Murray's Handy Classical Maps. Palestine, etc. Edited by G. B. Grundy, M.A., of Brasenose College, Oxford. London: John Murray. *Price* 1*s.* *Presented by the Publisher.*

The following maps are given upon this sheet: Palestine, illustrating Old and New Testament History, according to the Palestine Exploration Surveys, with an inset showing Jerusalem and surrounding district; the countries mentioned in the Old Testament, with an inset on a smaller scale, giving Babylonia, Assyria, Media, and Susiana; the countries mentioned in the New Testament, illustrating the journeys of St. Paul. They are all orographically coloured, and accompanied by an index to the names of places given on the maps.

Siberia. **Toll.**

Geologische Skizze der Neusibirischen Inseln und Teilen der Flüsse Jana, Lena, Olenek und Anabar. Von Baron E. Toll, 1899. Petermanns Geographische Mitteilungen Jahrgang 1900. Tafel 13. Gotha: Justus Perthes, 1900. *Presented by the Publisher.*

NORTH AMERICA.

Central America. **Sapper.**

Vulkan-Skizzen aus Guatemala und Salvador aufgenommen von Dr. Carl Sapper, 1898. Petermanns Geographische Mitteilungen Jahrgang 1900. Tafel 12. Gotha: Justus Perthes, 1900. *Presented by the Publisher.*

INDIAN OCEAN.

Indian Ocean. **Royal Netherlands Meteorological Institute.**

Waarnemingen in den Indischen Ocean over de Maanden Juni, Juli en Augustus. Koninklijk Nederlandsch Meteorologisch Instituut. Lithografie van Tresling and Co., Amsterdam. 22 sheets. *Price* 5 *fl.* 50 *c.* *Presented by the Royal Netherlands Meteorological Institute.*

This is the third part of a meteorological and physical atlas of the Indian Ocean, which is being published by the Royal Netherlands Meteorological Institute, under the superintendence of Dr. J. P. van der Stok. It has been compiled from a vast number of observations, and illustrates the surface temperature of the water, currents, barometric pressure, temperature of the air, rainfall, storms, etc., of the Indian Ocean for the months of June, July, and August. There are in this part altogether twenty-two charts, which, as they represent a good deal of original work, and have evidently been carefully compiled, should be of considerable interest to the student of physical geography as well as of practical value to the navigator.

GENERAL.

World. **Johnston.**

The Royal Atlas of Modern Geography. W. and A. K. Johnston, Edinburgh and London, 1900. Fifty-six maps and index. *Price* £6 6*s.* *Presented by the Publishers.*

This edition of Johnston's well known "Royal Atlas" does not contain any maps that have not previously appeared, and nothing more seems to have been attempted than to bring the work up to date. In some respects, however, further revision is necessary, as in the map of Central Asia, upon which the Transcaspian railway is only shown as opened as far as Khokand, and the branch line to the south from Merv is not indicated, whilst in the maps of North America and Western Canada it is evident that full advantage has not been taken of the most recent surveys, especially in the Rocky Mountain regions. There are other points that need attention to bring the atlas up to date, and in some instances the colouring is rough, and not altogether what might be expected in a work of this class; but, doubtless, these matters will be set right in another edition. It would also be an advantage if the publishers could see their way to add a few general physical maps.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, May and June, 1900. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
536	m = 1·0	England, south coast:—Royal Sovereign shoals to Dungeness. 1*s.* 6*d.*
3116	m = 1·1	Scotland, west coast:—Island of Islay. 2*s.*
1150	m = 6·9	River Thames:—Erith to Broadness. 2*s.* 6*d.*
3118	m = 1·4	Norway, west coast:—Batalden to Vangsö, including Fröisiöen. 2*s.* 6*d.*
1308	m = 4·0	Greece, east coast:—Head of the gulf of Nauplia. 1*s.* 6*d.*
3119	m = 8·0	Egypt, north coast:—Alexandria harbour. 2*s.* 6*d.*
1142	m = 3·2, 9·9	Brazil:—Port of Cape Frio, north cove. 1*s.* 6*d.*
556	m = 1·0, 3·9, 5·8	Plans in Magellan strait:—Coast between Glascott point and Cape San Isidro, Fortescue and Cordes bays, etc., Carreras bay, Sung bay, Notch cove (reproduction). 1*s.* 6*d.*
3136	m = 2·9	Anchorages in Alaska:—Karluk anchorage, Larsens bay, Uyak anchorage. 1*s.* 6*d.*
2402	m = 0·65	China sea:—Straits of Durian, Sugi, and Chombol. 1*s.* 6*d.*
1153	m = 0·58	Celebes, north coast:—Pulo Motuo to Tanjong Lutuno. 1*s.* 6*d.*
2880	m = 2·7, 2·9, 4·0	Japan, bays on the north and west coasts of Kiusiu:—Tomioka bay, Kuchinotsu bay, Tobo Byochi. 1*s.* 6*d.*
3114	m = 9·8	Japan, anchorages in Simonoseki strait:—Moji Ko. 1*s.* 6*d.*
131	m = 5·8	Japan:—Kurusima no Seto. 1*s.* 6*d.*
3131	m = 2·9, 5·9	Anchorage in New Hebrides islands:—Hog harbour, Lonock bay. 1*s.* 6*d.*
3036		Balearic islands:—Plan added, Harbour and anchorage of Palma.
577		British Columbia:—Plan added, Telegraph cove.
3029		British Columbia:—Plan added, Portier pass.
1456		Africa, west coast, River Cameroon:—New plan, Ambas islands.
911		Anchorages between Borneo and New Guinea:—Plan added, Bula bay.
2193		Anchorages between Mindanao and Celebes:—Plan added, Kawio anchorage.
2718		Anchorages on the east coast of Celebes:—Plan added, Pajonge anchorage.
1519		Plans in the Si Kiang or West river:—Plan added, Sheung Lung rock.
2355		Anchorages in the Solomon islands:—Plan added, Pavuvu islands.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.		Cancelled by	No.
1187	Plan of Palma harbour on this chart.	New plan. Harbour and anchorage of Palma	3036
1518	Plan of Nauplia on this chart.	New plan. Head of the gulf of Nauplia	1308
530	Plan of port of Cape Frio on this chart.	New Plan. Port of Cape Frio	1142
556	Anchorages in Famine and Forward reaches.	New sheet. Plans in Magellan strait	556
900	Notch cove.		
2402	Straits of Durian, Sugi, and Jombol.	New chart. Straits of Durian, Sugi, and Jombol	2402
131	Kurusima no Seto.	New plan. Kurusima no Seto	131

Charts that have received Important Corrections.

No. 2587, Ireland:—Coastguard stations. 2050, England, south coast:—Approaches to Spithead. 394, England, south coast:—Spithead. 2793, England, south coast:—Cowes harbour. 2509, Scotland, west coast:—Ru Ruag to Gruinard bay. 2500,

Scotland, west coast:—Lochs Broom. 1887, Germany, west coast:—Eider river to Blaavand point. 2115, Denmark:—The Sound. 790, Denmark:—Approaches to Copenhagen. 175, Sicily:—Milazzo bay. 285, Newfoundland:—Orange bay to Gander bay. 2470, United States, east coast:—New Bedford harbour. 479, Anchorages in Puerto Rico. 2097, Trinidad:—Bocas de Dragos, port of Spain. 1493, Central America:—Port Chagres. 868, Ports and anchorages on the west coast of Central America. 2839, United States, west coast:—Columbia river. 2840, British Columbia:—Haro strait and Middle channel. 1500, Alaska:—Kadiak island to Seguam island. 1421, Africa, east coast:—River Cuinde. 2636, Strait of Makassar, north part. 2577, Philippine islands, between St. Bernardino and Mindori straits. 2454, Philippine islands:—Northern portion of Luzon. 2562, China, south coast:—Canton river. 857, China, Kyau chau bay. 1258, Korea:—Approaches to Séoul. 913, Korea, west coast:—Mackau group to Clifford islands. 836, Japan:—Amakusa islands and Yatsushiro sea. 205, Japan:—Nanao harbours. 1750, South Australia:—Port Adelaide. 2726, New Zealand:—Manukau harbour. 2421, Tonga or Friendly islands.
(*J. D. Potter, Agent.*)

United States Charts. **U.S. Hydrographic Office.**

Pilot Charts of the North Atlantic Ocean for July and August, 1900, and North Pacific Ocean for August and September, 1900. U.S. Hydrographic Office, Washington, D.C. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

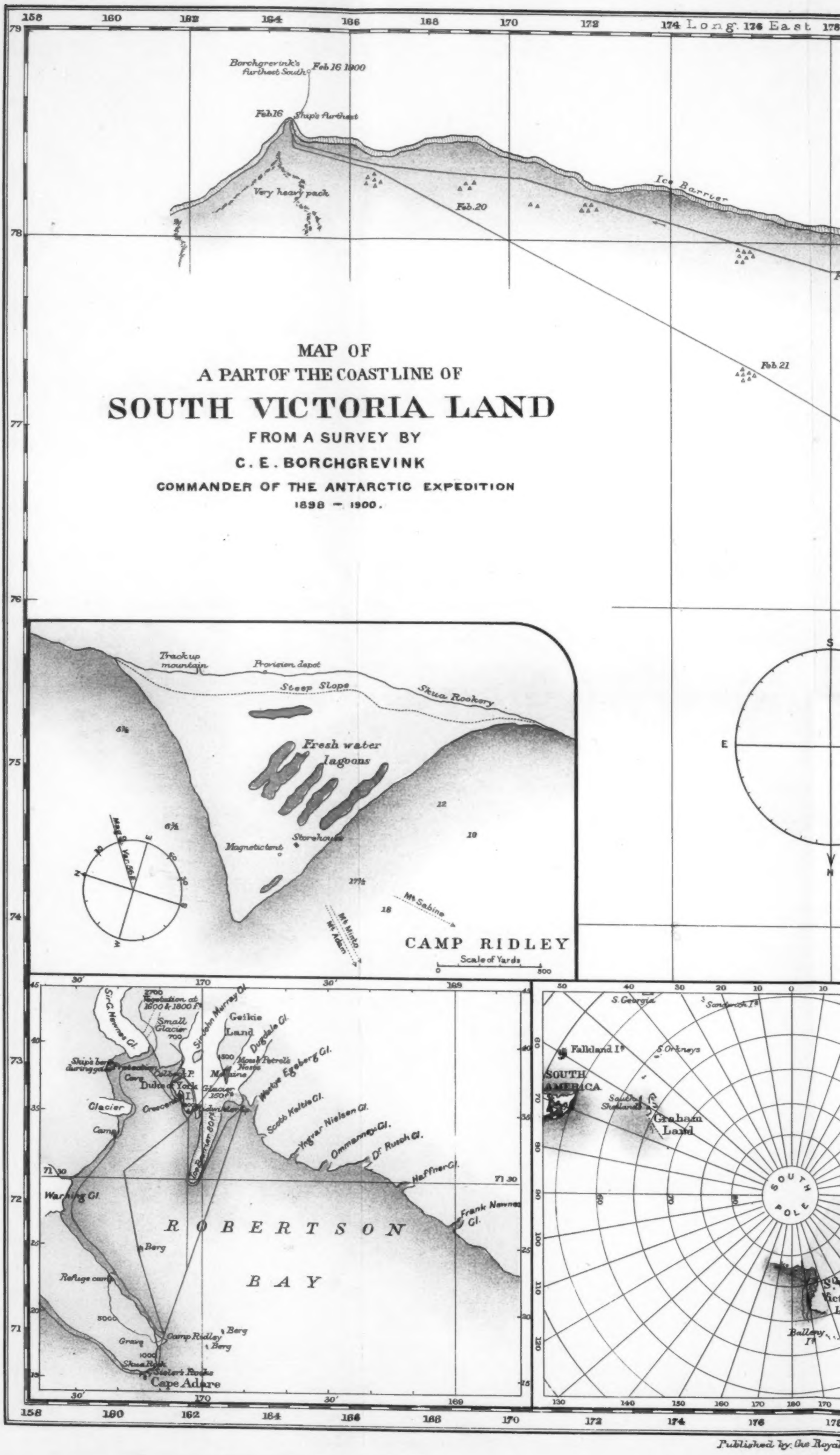
China. **Jack.**

Forty-eight Photographs of the Yangtse Valley and Sechuen, by R. Lockhart Jack, Esq., 1900. *Presented by Dr. R. Logan Jack.*

In view of the present general interest in China, these photographs, which were taken in the early part of the present year, are specially interesting. They are about 5 inches by 4 inches in size, and many of them are remarkably clear. The following is a list of their titles:—

(1) Wu-hu; (2, 3) Pagoda at N'gan Kin; (4) Orphan rock, with monastery and pagoda, below Kiukiang; (5) Steamer Shazi (Butterfield and Swire), Hankau; (6) Timber raft above Hankau; (7) East end of Hoang-ling gorge; (8) Geological Party's houseboat in the Middle Rapid, Chin-tan (Hupeh); (9) Dr. R. L. Jack; (10) J. F. Morris; (11) R. Lockhart Jack; (12, 13) Junk going down Yangtse; (14) Contortions in sandstones and shales, Tai-tse-wan; (15) Gate of temple (interior) at Wu-shan; (16) Buddhist monks, Wu-shan; (17, 18) Salt well in dry bed of Yangtse at Kwei-fu, Szechuen; (19) Salt waiting to be taxed at Likin station, Kwei-fu; (20) Looking up the Sin-tan (New Rapid), Sechuen; (21) Junk being tracked up the Sin-tan (New Rapid); (22) Trackers hauling up junk at Sin-tan; (23) Pagoda at Wan-hien, Sechuen; (24) Bridge at Wan-hien; (25) Buddhist temple at Shi-pao Shih, Sechuen; (26) Pagoda giving access to Buddhist temple at Shi-pao Shih; (27) Top of pagoda from entrance to temple at Shi-pao Shih; (28) Looking down the Sin-tan (New Rapid); (29) Bridge at Ning-shih, Sechuen; (30) Roadway of bridge at Ning-shih; (31) Life boat ("Red Boat") which followed the Geological Party from Ichang to Chung-king; (32, 33) Arch over roadway of bridge at Ning-shih; (34) Hospital at Lo-tsi-se, near Chung-king; (35) Bridge, 3 miles east of Ning-shih; (36) Sampans supporting tracking lines over a shallow rapid; (37) Bow-pilot of Geological Party's houseboat; (38) Buddhist temple, Lung An; (39) Idol in the temple, Lung An; (40) Cantilever bridge on the Fu Kiang; (41) A Mantsu village; (42) Garden of Magistrates, Yamenat Wen Chuan; (43) Idol (Goddess of Mercy) in the temple at Lung An; (44) Roofed bridge, gorge of the Fu Kiang; (45) Sifan tribesmen; (46) Ching Ping Kwan; (47) Cha Erh Ngai, a typical flat-roofed Sifan village; (48) Temple of Li Ping, the engineer who designed the irrigation system for the Cheng-tu Plain, Kwan Hsien.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.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174 Long. 176 East
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74
Borchgrevink's furthest South
Feb 16 1900
Feb 16
Ship's Furthest
Very heavy pack
Feb 20
Ice Barrier
Feb 21
MAP OF
A PART OF THE COAST LINE OF
SOUTH VICTORIA LAND
FROM A SURVEY BY
C. E. BORCHGREVINK
COMMANDER OF THE ANTARCTIC EXPEDITION
1898 — 1900.
Track up mountain
Provision depot
Steep Slope
Skua Rookery
Fresh water lagoons
Magnetic tent
Storehouse
Mt Sabine
Mt Minto
Mt Adam
CAMP RIDLEY
Scale of Yards
0
500
Var. 55 E
Sir G. Newnes Gl.
2700 Elevation at 1600 & 1800 Ft
Small Glacier
700
Sir John Murray Gl.
Geikie Land
Dugdale Gl.
1500
Mount Petrel's Nests
Matterhorn
Glacier 150 Ft
Mortar
Egeberg Gl.
Ship's berth during gale
Cape
Duke of York I.
Glacier
Camp
Crescent Bay
Scott Keltie Gl.
Ingvar Nielsen Gl.
Ommanney Gl.
Dr Rusch Gl.
Haffner Gl.
Frank Newnes Gl.
Warming Gl.
ROBERTSON
BAY
Berg
Refuge cairn
5000
Camp Ridley
Berg
Berg
Grave
1000
Skua Rook.
Skelet's Rocks
Cape Adare
S. Georgia
Sandwich Ld
Falkland Is
S. Orkneys
SOUTH AMERICA
South Shetlands
Graham Land
SOUTH POLE
Balleny Is
Published by the Royal

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"Southern Cross"

Parry Mountains
Mt Erebus
Mt Terror
C. Crozier
C. Tennyson
C. Bird
Mc Murdo Bay
Beaufort I.
Prince Albert Mountains
Franklin I.
Cape Bernacchi
Cape Gauss
C. Neumayer
Ice Barrier
Heavy pack
Cape Washington
Mt Melbourne
Newnes Land
C. Johnson
C. Sibbald
Lady Newnes Bay
C. Anna
C. Oscar
Coulman Id
C. Wadworth
C. Phillips
C. Cotton
C. Hallett
Mowbray Bay
Possession I.
C. McCormick
C. Downshire
Admiralty Range
Cape Adare
C. Wood
Robertson Bay
Smith Inlet
C. Oakley
C. Moore
Yule Bay
C. Hooker
Cape North

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Enderby Ld
Kemp Ld
Sabrina Ld
Victoria Ld
Magnetic Pole Approx.
Adelie Ld

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